Interactions Of Ethiopian Herbal Medicines And Spices With Conventional Drugs

A PRACTICAL GUIDE

Fekadu Fullas, RPh, PhD

Interactions of Ethiopian Herbal Medicines and Spices with Conventional Drugs

A Practical Guide

Fekadu Fullas, RPh, PhD

Interactions of Ethiopian Herbal Medicines and Spices
with Conventional Drugs. A Practical Guide

3135 Grandview Boulevard
Sioux City, Iowa, 51104
United States of America

Cover design by A.J. Phillips Publishing Co., Inc.
South Sioux City, Nebraska

Cataloging-in-Publication Data on file for this title
at the Library of Congress.

About the Author

The author was trained in pharmacy in Addis Ababa University, Addis Ababa, Ethiopia. He holds a Ph.D. degree in pharmacognosy (natural products science) from the University of Illinois at Chicago, USA. He has accomplished productive post-doctoral research work on plant derived anti-cancer compounds at the Research Triangle Institute in North Carolina, under the direction of the world-renowned natural products scientist, the late Dr. Monroe Wall. He was then promoted to a Research Chemist position in the same institution. As a practicing hospital pharmacist at the time of writing this book, he has also witnessed the conflation of the two ends of the pharmacy spectrum (the meeting of basic bench drug discovery research and therapeutic application of drugs in the hospital) in his career journey from pharmacy training, practice, through natural products research, and back to pharmacy practice. With over 40 publications to his credit, including several refereed scientific papers, he has extensive background in natural products, particularly those with potential medicinal applications. Recently, he has authored two books on various aspects of Ethiopian medicinal plants. The current volume is yet another contribution towards the emerging body of knowledge on the many facets of Ethiopian botanical medicine.

Contents

Acknowledgments ix

Foreword xi

Preface xiii

Chapter I

Principles of Drug Interactions: Some Relevant Issues 1

Where Herbal Medicine Meets Conventional Drugs 7

Interactions between Herbal Medicines and Conventional Drugs: A Brief Overview 11

Chapter II

The Nexus between Ethiopian Herbal Medicines and Conventional Drugs 19

The Case of P450 Polymorphisms in Ethiopians 24

Integration of Herbal Medicines and Conventional Drugs in Ethiopia 27

Chapter III

Monographs of Interactions of Ethiopian Herbal Medicines and Spices with Conventional Drugs

Aloes (***Eret***, ...) 33
Anise (***Ensilal***) 36
Basil (***Besobila***, ...) 39
Black mustard (***Senafitch***, ...) 42

Black and white pepper (***Qundo berbere***) 44
Black seed (***Tiqur azmud***, ...) 47
Capsicum peppers (***Berbere***, ...) 49
Castor (***Gulo***, ...) 53
Cinnamon (***Qerefa***, ...) 55
Clove (***Qirunfud***) 57
Coriander (***Dimbelal***, ...) 59
Cumin (***Ensilal***, ...) 61
Eucalyptus (***Bahr zaf***, ...) 63
Fennel (***Ensilal***, ...) 66
Fenugreek (***Abish***, ...) 69
Flax (***Telaba***, ...) 72
Garlic (***Netch shinkurt***,.....) 74
Ginger (***Zingibil***, ...) 79
Indian long pepper (***Timiz***) 83
Jimson weed (***Astenagir***, ...) 86
Khat (***Chat***, ...) 88
Lemon (***Lomi***, ...) 91
Lemongrass (***Tej sar***, ...) 93
Marijuana (***Etse faris***) 95
Myrtle (***Addes***, ...) 99
Nutmeg (***Gewz***) 100
Olive (***Woyra***, ...) 102
Onion (***Qey shinkurt***, ...) 104
Peppermint (***Nanna***,.....) 106
Plantain (***Gorteb***, ...) 109
Pomegranate (***Roman***) 112
Pumpkin (***Duba***, ...) 114
Rue (***Tenadam***, ...) 116
Safflower (***Suf***, ...) 118
Tamarind (***Homar***, ...) 120
Turmeric (***Ird***) 122
Verbena (***Attuch***, ...) 125
Withania (***Gizawa***, ...) 127

Appendix I 129

Appendix II 131

Appendix III 137

Appendix IV 143

Glossary 149

Index 163

Acknowledgments

I am most grateful to my family for providing a conducive household environment to complete this work. My special indebtedness goes to Dr. Worku Abebe who not only read the initial raw manuscript meticulously and made useful suggestions, but also graciously wrote a foreword to the volume. I wish to thank my colleague-in-pharmacy Dr. Corey Thieman for literature search on some general aspects of herb-drug interactions. Professor Ermias Dagne of the Chemistry Department of Addis Ababa University, Ethiopia, is recognized for his kind support as in the past.

Foreword

The use of traditional medicine has always been popular in Ethiopia. It is estimated that about 80% of the present Ethiopian population relies on traditional medicine for health care. While various categories of traditional medicine practices and practitioners are known to exist, with a few exceptions, the use of phytotherapy is a common factor among all of them.

It has been reported that plant-based therapy constitutes more than 80% of the substances used in traditional Ethiopian medicine. As with any other aspects of traditional medicine practice, herbal medicines are not regulated in Ethiopia. They are often used in the most crude forms without being subjected to any kind of standardization. As a result, their efficacy and safety are not guaranteed. Depending upon various factors, these materials are administered in different dosage forms and doses, either singly or in combination. They are either self-prescribed or made available by knowledgeable practitioners. At times, the herbs are consumed concurrently with conventional drugs, making the scenario more complicated. A substantial number of the medicinal herbs are also used as spices on regular basis by a significant number of the Ethiopian population. Literature survey reveals that most of the plant materials consumed for therapeutic purposes or as spices induce pharmacological effects of one sort or another. Therefore, it is plausible that a portion of the herbs used in traditional Ethiopian medicine or as spices can have interactions with conventional drugs taken concurrently. This may not only affect the therapeutic usefulness of the herbs but also that of conventional drugs, as documented in my recently published review articles. The present book by Dr. Fekadu Fullas is intended to deal with the complex issue of herb-drug interactions in the Ethiopian context.

The author holds a PhD degree in pharmacognosy, with background education in pharmacy. He has extensive experience in medicinal plant research and pharmacy practice. In addition to publishing a number of research articles in his area of expertise, Dr.

Fekadu has written two books on Ethiopian traditional herbal medicines and spices. Therefore, he is well qualified to write the present book, which is the first of its kind, considering the emphasis it puts on herbal issues related to the Ethiopian situation.

In the first chapter of the book, as a refresher, the author provides a background on the principles of drug interactions, and some general aspects of herbal uses and herb-drug interactions. The second chapter deals with topics related to Ethiopian herbal remedies in relation to conventional drugs in general terms. Chapter three of Dr. Fekadu's book contains monographs of individual herb-drug interactions as its major section. In this chapter, the possible interactions of 38 commonly used herbs (identified by their common, scientific, and local names) with conventional drugs are described based on information obtained from the scientific literature. Along with this, the traditional uses of the herbs in Ethiopia and the managements of the consequences of the interactions with conventional drugs are described. In addition, the book contains four appendices of relevant information.

In sum, this book contains useful information needed by all health professionals in Ethiopia. It is a valuable resource material for research and teaching. Consumers can also benefit from the book more directly on personal level. It is a well-written book, which can easily be understood by the average reader. It, certainly, is a valuable addition to the growing knowledge on traditional Ethiopian medicine, and the author should be commended for a job well done.

Worku Abebe, BPharm, PhD
Assistant Professor
Medical College of Georgia
Augusta, Georgia, USA

Preface

This book is intended to serve primarily as a guide for screening herb-drug interactions, when Ethiopian physicians and other healthcare professionals review the medication history of patients in conjunction with herbal medicine and spice use for subsequent treatment plans. Reviewing herb-drug interactions is only a small part of a bigger puzzle in the complex process of decision-making in drug therapy. The book is also written in such a way that its contents can be fairly understood by the general public, without the need to delve into the scientific nuances. Ethiopian traditional medicine, particularly medicinal plant use, is bound to stay around for years to come. The consensus among many health experts, especially those in developing countries, is that traditional medicine should be integrated with modern medicine. Therefore, in this context, the need for awareness about beneficial and harmful interactions of traditional herbal medicines and spices with conventional drugs is of paramount importance. The interactions, no doubt, do play a significant role in patient treatment outcomes, when attempts are made to coalesce, or con-join the two systems. The main objective of this guide is precisely to outline these aspects, despite the fact that the science of herb-drug interactions is in its infancy, and still remains a barely explored area. Nonetheless, it is a continuously expanding discipline.

The ever-accumulating body of knowledge about herb-drug interactions hinges on integrating the concepts of various scientific disciplines to explain interaction phenomena. As our understanding of the basic mechanisms of drugs, the chemistry and pharmacological properties of medicinal plants expands, the issue of deciphering herb-drug interactions becomes less problematic and more meaningful in terms of its application in optimizing drug therapy. Presently, even the interactions within many conventional drugs are not fully known, although important strides have been made in our knowledge of how drugs are metabolized, and the enzymes involved in such processes. In Western poly-pharmacy culture, where the use of multiple medications and therapy duplications are not uncommon, the many possibilities of various interactions call for a closer evaluation of

drug regimens, dosing times, assessment of drug therapy duplications, and associated problems. Correspondingly, in the case of medicinal plants and the products that are derived therefrom, the multiplicity of chemical constituents and the mixing of many plants together present a unique challenge to healthcare providers in the prediction of herb-drug interactions. Obviously, poly-drug therapy, when coupled with poly-herb use, raises the concern and chances of interactions.

In Ethiopia, since access to modern medications is rather limited, the concern about poly-pharmacy and herbal medicine (or spice)-conventional drug interactions may not be on a par with that in the West. Yet, considering the fact that an estimated 80% of the population use traditional medicine, and a significant number of these people may use modern healthcare facilities at various care levels, it is imperative for healthcare professionals to inquire about prior or current use of herbal medicines, and about the use pattern of spice plant products when prescribing, dispensing, or administering drugs. Such inquiry is especially important in relation to narrow therapeutic index-medications, which require narrow concentration ranges in the blood stream to exert their optimal effects, and where slight deviation from the normal range can lead to medically catastrophic consequences.

This volume highlights herb-drug interactions for 38 traditionally used Ethiopian medicinal plants. The majority of these plants are primarily used as spices and flavoring agents in foods and beverages, although they also have utility as medicinal agents. A number of the interactions are well documented in scientific reports, while several are speculative, based on theoretical considerations. The profiled remedies and spice plants were selected on the basis of available interaction data in the scientific and professional literature. The monographs include synopses of the medicinal uses of the plants, both in Ethiopia and other parts of the world, followed by their interactions with conventional medications. Whenever available in the literature, a short description about the management of important interactions is provided at the end of each monograph. In view of the fact that they may have some potential medicinal values, and yet are known to be abused, a special exception has been made in the format

of the monographs for *Cannabis sativa* (marijuana) and *Catha edulis* (khat) by adding a special notes section, in which pertinent aspects of these plants are treated. A section which summarizes culinary uses has been included in the respective monographs of those herbs which are used both for therapeutic and flavoring purposes.

The author hopes that this treatise will stimulate research interest in further exploring herb-drug interactions for other medicinal herbs used in Ethiopian traditional medicine. Since Ethiopian physicians, pharmacists, nurses, and other health professionals occupy such unique positions in the official healthcare delivery system of the country as to affect treatment outcomes, they should vigilantly look for any signs of herb-drug interactions during their practice. By reporting their findings they can also contribute to the existing pool of knowledge on the subject. The Drug Administration and Control Authority (DACA) of Ethiopia, for example, can be tasked with coordinating the acquisition of interaction data from the country's health service delivery facilities. In due course, such accumulated data will in turn prove to be a good resource to draw upon, especially when attempts are made to optimally integrate traditional medicine with modern healthcare. In addition, it will alert health care providers to monitor herb-drug interactions closely.

Finally, while the author has made utmost effort to include all relevant information on possible herb-drug interactions in Ethiopian herbal medicine and spice usage, he disclaims responsibility for any untoward clinical consequences arising from application of the information contained in this volume.

Fekadu Fullas

September, 2006

♣♣♣ Chapter I ♣♣♣

Principles of Drug Interactions: Some Relevant Issues

The operational definition of drug interaction may vary. Some authors prefer to restrict the definition of drug-drug interaction to adverse reactions, and not to include beneficial interactions such as, for example, the use of ampicillin and probenecid. In a broad sense, a drug-drug interaction may be defined as a pharmacologic or clinical response to the administration of a drug combination different from that anticipated from the known effects of the separate agents when given alone. The interaction may manifest in antagonistic, additive, synergistic, or idiosyncratic effects. Idiosyncratic manifestations are responses unexpected from the known effects of the individual drugs. The clinical effects of drug interactions, regardless of how well they are documented, do not occur in every patient, or in the same degree of intensity. The incidence and degree of severity of an interaction depends on both patient-related factors and the dose, route, and other aspects of the herb and drug. Patient-related factors include the disease process itself, organ dysfunction, etc.[1] According to an estimate in the USA, drug-drug interactions are known to occur in 9-70% of patients in community and ambulatory care settings,

depending on the population studied and the methods employed. An analysis of prescriptions claims from a major Pharmacy Benefit Management (PBM) company found that 374,000 of 46 million plan participants in the USA had been exposed to a potential drug-drug interaction of clinical importance.[2]

The documentation reported in the biomedical literature regarding drug interactions should be evaluated carefully. Pinpointing the source of interactions is not always an easy and accurate exercise A well-established interaction is one that is proven in well-controlled trials. In this case, an altered pharmacologic effect must have been demonstrated in well-controlled human studies, and a pharmacokinetic interaction demonstrated, as well. Data derived from such studies provide the strongest evidence for interactions. A probable interaction is a very likely event, but without clinical evidence. Here, a pharmacokinetic interaction must be demonstrated in well-controlled studies as to affect kinetic parameters such as plasma drug levels, which may result in altered pharmacologic response of one of the drugs. Controlled human studies may be lacking. However, multiple case reports may support this kind of interaction. In some cases, an interaction may be suspected, or supported with good data, but not necessarily definitive. Another type is a possible interaction, for which data are limited.[1] Depending on the evidence and significance of the interactions, some authors have utilized numerical codes or levels to indicate interactions. For example, Zucchero, et al. have used codes 1through 4 to differentiate between interactions, with code 1 assigned to highly significant interaction, and code 4 for not clinically significant. In between are codes 2 and 3, which designate interactions that are moderately clinically significant and minimally significant, respectively. These authors assign code 1 to cases where the interactions cause great potential harm to the patient, whereas code 2 signifies a moderate potential harm. On the other hand, code 3-type interactions are of little harm to the patient, while code 4-interactions are not clinically significant at all.[3]

Time course, degree, and nature of interactions

The onset of interactions may vary according to the nature of substances involved. It may be as rapid as within 24 hours, or may be delayed by days or weeks to notice the effects of the interactions. The potential severity of the interaction also varies. In most instances, dose adjustments or changing times of administration may circumvent the problem. The degree of the severity of the interaction can be major as to be life-threatening or causing permanent damage to the patient. In other cases, the interaction may be moderate, causing a deterioration of the patient's condition. In many cases, it could only be bothersome with no discernible clinical significance.[1]

In general, there are two types of interactions: pharmacokinetic and pharmacodynamic interactions.

1. **Pharmacokinetic Interactions**:

In this type of interactions, one drug alters the absorption, distribution, metabolism, or excretion of another drug. This effect is usually measured by a change in one or more kinetic parameters, such as peak plasma drug concentration, also known as maximum serum concentration (C_{max}), area under concentration-time curve (AUC), time to reach C_{max} (T_{max}), half-life, the total amount of drug excreted in the urine, etc. The T_{max} relates to the rate of systemic drug absorption and elimination, while AUC relates to the amount or extent of drug absorption. The greater the amount of systemic drug absorption, the greater the AUC, which is expressed as concentration multiplied by time. Urinary drug excretion gives a good indication of the bioavailability, if the active drug is excreted unchanged in a significant quantity in the urine. In this situation, the cumulative amount of active drug excreted in the urine is directly related to the extent of systemic drug absorption, and the rate of excretion is also directly related to the rate of systemic drug absorption. The time for the drug to be completely excreted corresponds to the total time for the drug to be systemically absorbed and completely excreted in the urine. AUC is a measure of bioavailabilty. Relative bioavailability,

expressed as the ratio of AUCs of two products, indicates how one product compares to another product of the same drug, but the ratio does not indicate completeness of systemic drug absorption. For example, a relative bioavailability of 0.8 or 80% indicates the product is only 0.8 times as available as the other product. On the other hand, absolute bioavailability indicates a ratio of the AUC of a dosage form of a drug to the AUC of the same drug administered by intravenous route.[4]

A. Absorption and Distribution:

There are many mechanisms by which oral drug absorption is altered, such as change in splanchic blood flow, gut motility, pH, drug solubility, gut metabolism, flora, or gut mucosa. Most clinically significant interactions arise from the formation of non-absorbable complexes by either chelation (e.g., tetracycline or ciprofloxacin and di- or tri-valent cations), adsorption (e.g., lincomycin and kaolin-pectin) or ion exchange (e.g., cholestyramine and warfarin). Altered distribution is not a common and clinically important mechanism of interaction. Some highly plasma protein-bound drugs may be displaced from the inactive binding sites by another more highly bound drug. Without a marked change in total serum concentration, the concentration of free and active (not bound) drug may increase to cause toxicity or enhanced response.[1]

B. Metabolism and Excretion:

A major pharmacokinetic interaction occurs at the stage of metabolism. Most agents are lipid soluble, and cross the lipid plasma membrane of receptor sites to exert their effect. Metabolism converts these agents mostly to inactive water-soluble products for excretion. The process involves a series of enzymes, many of which are concentrated in the smooth surface of the endothelium of liver cells. These enzymes are called hepatic microsomal enzymes. In the first asynthetic stage (Phase I) of metabolism, the enzymes oxidize, demethylate, and hydrolyze the active drug, followed by a synthetic

stage (Phase II), in which endogenous water-soluble molecules such as glucuronic acid, sulfate, etc. are attached to the simplified form of the drug to render it inactive, water-soluble, and thus excretable.[1]

An important group of hepatic microsomal enzymes are the cytochrome P450 isoenzymes (isozymes or isoforms). They are also known as "mixed function oxidases," or "mono-oxygenases." They are responsible for the metabolism of the majority of drugs. They can be induced or inhibited by other drugs. The entire group of cytochrome P450 enzyme system represents a superfamily (CYP), which in turn includes families designated by an Arabic or Roman numerals (e.g., CYP2 or CYPII), These families are further divided into sub-families designated by adding a letter (e.g., CYP2D or CYPIID), based on the similarity of the encoded isozyme protein. The individual gene is designated by appending an Arabic numeral at the end (e.g., CYP2D6 or CYPIID6). Many drugs have been identified as substrates, inhibitors, and inducers of metabolism by CYP enzymes. A drug that inhibits a certain isozyme may decrease the metabolism, and therefore increase the serum concentration of another drug that is the substrate of (is metabolized by) that isozyme. The converse holds true for inducers, which effect a decrease in the serum concentration of the other drug and its effects.[5]

The key human metabolizing enzymes are CYP1A, CYP2A, CYP2B, CYP2C, CYP2D, CYP2E, and CYP3A (see Appendix IV). These CYP enzymes are responsible for the partial metabolism of about 75% of all drugs, with CYP3A being responsible for nearly half of this activity. The approximate relative contribution of these isozymes in decreasing order of magnitude is CYP3A4 (50%), CYP2D6 (25%), CYP2C8/9 (15%), and then CYP1A2, CYP2C19, CYP2A6, CYP2E1. Each enzyme subfamily shows unique selectivity toward certain drugs, depending on the chemical structure, size, lipophilicity, and other attributes of the substrate drug. For example, CYP1A2 has preference for medium-sized, planar, lipophilic drugs, while CYP2D6 preferentially binds to substrates that possess a basic nitrogen atom.[5] Inhibition is substrate independent, which means, for example, a potent inhibitor of CYP3A4 is very likely to inhibit the metabolism of any drug metabolized by CYP3A4. It is also worth

noting that an inhibitor may affect one isozyme at one dose level, but may require a larger dose of the inhibitor to inhibit another isozyme. For example, fluconazole inhibits CYP2C9 at low doses such as 100 mg/day, but inhibits of CYP3A4 in the dose range 200-400 mg/day. Other characteristics of inhibitors include the following: they may affect more than one isozyme (e.g., fluoxetine inhibits both CYP2C19 and CYP2D6); the magnitude of inhibition of drug metabolism tends to be dependent on the dose of a given inhibitor; some substrates have multiple pathways of metabolism within the P450 system (e.g., diazepam is metabolized by both CYP2C19 and CYP3A4, and tricyclic antidepressants are metabolized by many CYP450 isozymes). Isozymes in some cases may also be stereoselective. For example R-warfarin is metabolized primarily by CYP1A2, while the more potent S-warfarin is metabolized by CYP2C9. Thus, inhibition of CYP1A2 tends to produce only small increases in the hypothrombinemic response to warfarin, while inhibition of CYP2C9 can produce significant increase in warfarin response.[6]

Some CYP subfamilies exhibit polymorphism, manifested by allelic variants with differing catalytic properties. The enzymes CYP2C9, CYP2C19, and CYP2D6 have polymorphic variants. Individual humans who possess "wild type" gene alleles have normal metabolizing capacity, while others may have over-expressed or under-expressed allelic variants. Poor metabolizers are more likely to experience drug toxicity from drugs metabolized by the affected enzymes, or less effects if the particular enzyme is responsible to convert a pro-drug into its active form, as the case is with codeine. About 7% of Caucasians and 1% of Orientals appear to be, for example, CYP2D6 poor metabolizers.[5] The drug company Roche has developed "*AmpliChip CYP450 Test*" which analyses genetic variations in the activity of the cytochrome enzymes CYP2D6 and CYP2C19 to determine the metabolizer status of patients. This test is believed to help clinicians in prescribing individualized drug therapy.[7] However, considering its current cost of $500 per test,[8] the routine use of *AmpliChip* for individualized drug therapy is unlikely in the near future.

Another pharmacokinetic interaction involves altered

excretion. Examples of this mechanism include altered active transport in the kidney tubules, or pH effect on the passive transport of weakly acidic or weakly basic drugs. In the latter case, changes in urine pH (e.g., alkalinizing effect of some drugs) affects very few drugs. When evaluating interactions, it is important to assess the clinical significance, which in turn determines the need for monitoring the patient, altering the therapy, or adjusting the dose.[1]

2. Pharmacodynamic Interactions

This type of interaction is one in which a drug induces a change in a patient's response to another drug without altering the latter's pharmacokinetics. That is to say that one may see a change in drug action without altered plasma concentration. For example, toxicity from digoxin can result from low potassium level in the blood caused by potassium-wasting diuretics. Other examples of such interactions include additive CNS depression, additive anti-cholinergic effects, potentiation of neuromuscular blockade, additive cardiac depression, changes in the various components of blood coagulation cascade, and changes in blood sugar levels. Pharmacodynamic interactions are sometimes described as pharmacological interactions, in which concurrent use of two or more agents with similar or opposing pharmacological actions are involved.[1] The interactions occur mostly at the sites of drug action. These sites include receptors, ion channels, cell membranes, and enzymes. Some of the interactions are exploited for therapeutic benefits. The interactions of competitive antagonists at receptor sites are the basis for the development many useful drugs. To illustrate, naloxone, propranolol, and flumazenil reverse the effects of opiates, catecholamines, and benzodiazepines, respectively at their receptor sites.[9]

Where Herbal Medicine Meets Conventional Drugs

For millennia on end, medicine and natural products have been intimately linked through the use of traditional medicines and

poisons. Clinical, pharmacological, and chemical studies of these traditional remedies have led to such important therapeutic agents as aspirin, morphine, quinine, and pilocarpine.[10]

There is a close association between the use of plants in traditional medicine and that of drugs obtained from them. In a paper published in 1985, Farnsworth et al. reported that of the 119 plant-derived drugs, 88 (74%) were discovered as a result of chemical studies to isolate the active constituents responsible for the use of the original plants in traditional medicine[11] A survey of drugs that were made available in the market from 1981 to 2002 demonstrated that in the area of anti-cancer agents alone, 62% of the drugs were derived from natural sources. During the same period, in the anti-hypertensive area, 48 of the 74 launched drugs were derived from, or were mimics of natural products. In a similar manner, 7 of the 10 anti-migraine drugs that were introduced into the market in this time frame were based on the natural serotonin molecule.[12] In 2002, two categories of plant-derived anti-cancer agents (the taxanes represented by paclitaxel and docetaxel, and the camptothecin analogues irenotecan and topotecan) sold just under $3 billion, an amount approximately about a third of the total anti-cancer drug sales worldwide.[13] It is also important to note that in the years 2000, 2001, and 2003, a significant number of natural products, or their derivatives were well represented in the top 35 drugs sold worldwide.[10]

The estimated number of plant species in the world is in the range 297,000 to 510,000. About 53,000 (6%-9%) of these species have medicinal uses.[14] In Africa alone, there are about 45,500 plant species, out of which 15,000 (66%) are endemic, and 4,500 (about 10%) are rare species. About 1/3 rd of the continent of Africa is forested, but less than 10% of these forest areas is protected.[15] Of the 27,000 species that are found in China, 11,146 (41%) are used as medicinal plants. India boasts about 17, 000 plants species, of which 7,500 (44%) are medicinal. There are about 20,000 plant species in North America, out of which 2,572 (13%) are used medicinally. About 2,237 (7%) of Mexico's 30,000 plant species are used in traditional medicine.[14] A total of 1,400 various herbal preparations are found in member states of the European Union.[16] Each African

country has a sizable number of medicinal plants used in traditional health-care, for example, about 400 in Kenya,[17] about 500 in Zimbabwe,[18] about 700 in South Africa,[19] and 650 to 1,000 in Ethiopia.[20] In all these countries and throughout the world, herbal medicines are used to varying degrees along with conventional drugs.

Medicinal plant trade has shown tremendous growth globally. China is estimated to export 120,000 tons of medicinal plant products per year, while India exports about 32,000 tons per year. In 1996, 26,500 tons of medicinal and aromatic plant materials were exported from Africa to Europe. Bulgaria, Germany and Poland are also major exporters of medicinal plant products.[16] In1999, the total world-wide sale of herbal products was in the order of US $19.4 billion, with Europe's share being $6.7 billion, followed by Asia ($5.1 billion), North America ($4.0 billion), Japan ($2.2 billion), and the rest of the world ($1.4 billion).[14] It is evident that herbal medicines have a substantial share of the world market of therapeutic agents, although not quite on a par with synthetic conventional drugs.

The use of botanical remedies has also shown explosive growth worldwide recently. In a 1990 survey, it was reported that one-third (33.8%) of Americans used various alternative therapies, and a significant portion of these therapies involved the use of botanical products.[21] In 1997, the number of people using alternative therapies rose to 42.1%, and of all other therapies, use of herbal remedies showed the most growth. A staggering $3.24 billion was spent on herbal products by the American public in 1997. Surprisingly, only about a third of the people taking botanical products revealed to their physicians about their use.[22] A 1999-survey of a representative sampling of 2,000 adults conducted by Prevention Magazine and Princeton Research Associates revealed 49% of Americans used herbal remedies in the 12 month-period prior to the study, while 24% claimed they regularly used an herbal remedy. About 31% used herbal remedies with prescription drugs, and 30% used them along with over-the counter (OTC) drugs.[23] In 2001, a pilot study of 164 herbal medicine users in the UK indicated that 59% had taken herbal products and conventional medicines concurrently during the previous year. In Canada, a survey of

195 elderly patients revealed that 95% were using at least one prescription medication, and 17% (33 patients) were using at least one dietary supplement (herb, minerals, or other dietary supplement). The study further indicated that of the 33 patients, nine were at the risk of suffering from an herb-drug interaction. Considering the fact that patients are reluctant to disclose their use of herbal products concurrently with conventional medications, there is a serious concern that health professionals may not be able to monitor interactions thoroughly.[24] It is interesting to note that according to a Gallup poll, two-thirds of Canadians believe herbal supplements are as effective as prescription or OTC medications.[25]

The so-called dietary botanical supplements are slowly trickling into mainstream medicine. In European countries, such as Germany, Italy, Austria, and Switzerland herbal products are an integral part of conventional medicine.[26] They are prescribed by physicians, and insurance agencies reimburse varying amounts for the purchase of herbal products. In 1993, $1.9 billion was spent in Germany on plant-derived medicinal agents, excluding single or multiple-ingredient pharmaceutical products of plant or other natural origin. Over 54% of these products were prescribed by physicians. The products included remedies for heart conditions, circulatory problems, cough, cold, respiratory problems, laxatives, cholagogues, and central nervous system agents. In Europe, research-based mainstream pharmaceutical manufacturers such as Bohringer, Boots, and Ciba-Geigy have entered the herbal market.[26] Although dietary supplements are monitored by relatively somewhat fuzzy regulations in the United States, the American public happen to be huge consumers of dietary supplements, including herbal remedies. The use of botanical supplements has been a contentious issue in organized medicine in the USA. In view of the vague regulations and accreditation requirements, health systems (ambulatory and acute care hospitals) are constantly confronted with the problem of not only ascertaining the quality and efficacy of botanical products that patients may be allowed to take as in-patients, but also with the intricacy of developing mechanisms to monitor their use, and their possible interactions with conventional drugs. In 2004, a national

online survey[27] was conducted to determine institutional policies and practices related to the use of dietary supplements in the United States. Responses obtained form 302 hospital pharmacy directors indicated that 62% of the facilities had developed and implemented some kind of policy, while 38% didn't have any policy in place at all. Fullas and Hailemeskel[28]have outlined the problems and challenges associated with the use of botanical supplements in health systems in the USA.

Interactions Between Herbal Medicines and Conventional Drugs: A Brief Overview

Herbal products are usually mixtures of many substances. It is not always known how many of the ingredients in an herbal product are pharmacologically active. The multitude of possible active ingredients in a medicinal plant (s), or a botanical product increases the likelihood interactions with conventional drugs. Confounding the problem of analysis of interactions is the content variation of many herbal medicines.[29]A report which disclosed blending of certain Chinese patent medicines with pharmaceutical products illustrates this situation. About 23.7% of 2,609 samples of traditional Chinese medicines collected from eight hospitals in Taiwan contained pharmaceutical adulterants such as caffeine, paracetamol, indomethacin, hydrochlorothiazide, and prednisolone. Many Chinese patent medicines sold outside of Asia were found to contain non-steroidal anti-inflammatory agents (NSAIDs) and benzodiazepines. Twenty four of 251 patent medicines collected in herbal stores in California, USA contained lead; 36 products contained arsenic; and 35 contained mercury.[30] Analysis of nine Chinese herbal dermatological creams revealed that eight were spiked with steroids. These findings do not diminish the usefulness and efficacies of traditional Chinese medicines, or other long-used herbal therapies. It just shows how quality control failures and lack of regulations and surveillance can potentially generate negative notion and bias against traditional medicine.[31]

Much of the literature on herbal medicine may be limited by

the fact that many authors of clinical case reports do not define accurately the botanical source that their data are derived from. Unless extra caution is taken when evaluating these reports, an adverse reaction due to toxicity may be mistaken for herb-drug interactions.[29] Reports reflecting critical analyses are beginning to appear in mainstream medical literature.[32,33] For example, a systematic analysis of 108 cases of suspected herb-drug interactions demonstrated that 68% were not evaluable, 13% were well documented, and 18.5% were marked as possible interactions.[33] According to a survey of 260 patients in Pittsburgh, and 198 in Los Angeles at Veteran Affairs (VA) medical centers, a total of 197 patients (43%) were reported as taking dietary supplements (herbals included) and prescription medications concurrently. About 89 potential interactions were assessed. Most of these interactions were found not to be severe. The authors of the article acknowledge the limitations of their survey in that the sampling of patients may not be representative of veterans at the two sites, and that the results also may not be generalizable to other veterans and different patient population groups.[34] In a small survey of 100 customers visiting a health food store in the USA, Hailemeskel et al. detected cases of potential herb-drug interactions between valerian (*Valeriana officinalis*) and cyclobenzaprine, St. John's wort (*Hypericum perforatum*) and fluoxetine, kava-kava (*Piper methysticum*) and lorazepam, black cohosh (*Cimicifuga racemosa*) and benazepril/amlodipine, and bayberry (*Myrica cerifera*) and valsartan. With the exception of the last case, where the interaction effects may be antagonistic, the other interactions are believed to result in enhanced effects.[35]

It is evident that medicinal herbs, just like conventional drugs, are therapeutic at one dose level and toxic at another dose level. Interaction between herbs and drugs may increase or decrease the therapeutic or toxicological effects of either component, which complicates dosing of long-term medications. The dearth of reports on herb-drug interactions is probably due to a combination of factors, including under-reporting, and the benign nature of the reactions. Because of this, the true prevalence of interactions both within

conventional drugs, and between herbs and pharmaceuticals is not known.[30] As of 1996, a total of 5,000 herb-related adverse events were reported,[36] but it is not clear how many of these were results of herb-drug interactions. Some reported interactions could also be a result of impurities or contaminants in the medicinal plant materials interacting with drugs.[37] Some of the better known herb-drug interactions have been traced back to constituents of plants reacting with cytochrome P450 enzymes. These constituents form reactive intermediates capable of irreversibly inhibiting various CYPs, leading to the inactivation of the latter. Mechanistically, the reactive metabolites bring about chemical modification of the heme or the apoprotein, or both in the CYP as a result of covalent bonding of the modified heme to the apoprotein. Examples of herbs/constituents which involve CYP in their interactions with drugs include capsaicin from chilli peppers, the isoflavan glabridin from licorice root, isothiocyanates from cruciferous plants, oleuropein from olive oil, and diallyl sulfone from garlic. Therefore, this mechanism-based inhibition of CYPs may provide explanation for some reported herb-drug interactions.[38] Some herbs which are known or suspected to interfere with drug-metablolizing P450 isozymes are summarized in Appendix I. Other examples which also include other routes of interaction mechanism are listed in Appendix II.

Systematic documentation of herb-drug interactions in the professional literature started only recently. Articles are beginning to be published in mainstream medical journals, as well as in those that focus on alternative medicine.[39] A range of botanical products, inclusive of garlic, ginger, and turmeric are known or suspected to lead to bleeding episodes, when taken in conjunction with prescription or over-the-counter analgesic medications.[40] Various herbs have been reported to potentially interact with drugs used in dental practice and oral health.[41] Some herb-drug interactions are relatively well documented. For example, it is known that using sympathomimetic herbal product ephedrine will result in acute hypertension when combined with monoamine oxidase inhibitors (MAOIs). The medicinal herb St John's wort (*Hypericum perforatum*) is known to be an inducer of CYP3A4, and perhaps also

induces CYP2C9 and *p*-glycoprotein. This property of St. John's wort renders substrates of these isozymes and transporters (*p*-glycoproteins) less effective.[6]

Although drug-drug interactions constitute the bulk of current pharmacokinetic literature, herb-drug interactions are gaining more attention. Data about drug-drug interactions are derived from various sources, including pre-drug approval clinical studies, and post-marketing in vitro, in vivo, and various human studies, as well as from adverse reaction surveillance, so-called Adverse Drug Reports (ADR) monitoring system in the United States. The situation for drug-herb interactions, however, is different in that the data are derived from studies outside of the regulatory framework of the drug approval and monitoring process. In comparison to drug-drug interaction data, there are only a few herb-drug interaction studies in humans.[42]

Brinker classifies herb-drug interactions based on the type0 of studies carried out to determine interactions. Thus he identifies 4 main categories, based on levels of evidence: (I) information obtained from human or pharmacological studies, case reports, or clinical experience; (II) data obtained from animal research; (III) speculative data based on in vitro studies or evaluations based on known mechanism of action; and finally (IV) dubious information based on flawed or uncertain evidence The most reliable are those that are derived from human studies, particularly those trials in ill patients and/or medicated patients, and empirical observations such as those described in case reports. Laboratory tests utilizing live animals rank second in terms of evidence extrapolated to human beings. These extrapolations do not necessarily hold true in human clinical situations.[43] Experimental herb-drug interaction data are limited, case reports scarce, and case series rare. This is also true for drug-drug interactions, since published clinical studies are mainly case reports, rather than controlled trials, the reason being that it is unethical to assign patients to trials that examine unintended effects.[30]

The likelihood of herb-drug interactions could be higher than drug-drug interactions in view of the fact that a single plant remedy may contain several pharmacologically active substances.[33] It has

been widely reported that the concurrent use of long-term medications such as anti-diabetic agents and herbs with anti-diabetes properties may precipitate hypoglycemia.[30] Although no definitive correlation was established, a case report from South Africa suggested the contributory role of a thiazide diuretic in exacerbating acute renal failure (ARF) in a patient who had ingested a local *Aloe* species. Various aloe products are consumed by traditional communities to "cleanse the stomach," and relieve abdominal discomfort.[44] Some herbal products may form an insoluble complex with drugs in the GI tract. The complex formed in this manner is not absorbed, or poorly absorbed, thus adversely affecting the activities of both the herb and drug.

It is speculated that the number of interactions increases exponentially as the number of therapeutic agents increases. If two products are taken together, the risk of interactions is 6%; for five products it may rise to 50%; for eight or more products the risk of interactions can rise up to 100%.[45] One study showed that of 1,000 elderly patients admitted to a hospital, 538 were exposed to 1,087 drug-drug interactions.[30]

References

1. Tatro DS, ed. Drug Interaction Facts. St Louis, MO: Facts and Comparisons; 2001; pp xi-xxiii.
2. Malonie DC, Hutchins DS, Haupert H, Hansten P, et al. Assessment of potential drug-drug interactions with a prescriptions claims database. *Am J Health-Syst Pharm* 2005; 62: 1983-1991.
3. Zucchero FJ, Hogan MJ, Scultz CD. Pocket Guide to Evaluations of Drug Interactions Directory. 3rd edn. Washington, D.C.: American Pharmaceutical Association. 1999; pp xii-xviii.
4. Shargel L. Study Guide and Board Review; Pharmacy Review. Malvern, Pennsylvania: Harwal Publishing Compamny1989; pp 70-73
5. Lacy HC, Armstrong LL, Goldman MP, Lance LL. Drug Information Handbook. 13th edition. Hudson, OH: Lexicomp; 2005; pp 1678-1685.
6. Hansten PD, Horn JR. The Top 100 Drug Interactions. Freeland, WA: H&H Publications, LLP; 2006; p 150-161.
7. Anon. *AmpliChip CYP450 Test. The Med Lett* 2005; 47(1215/1216): 71-72.
8. Gates BJ, Davies NM. *AmpliChip* for Cytochrome P-450 Genotyping: The

Epoch of Personalized Prescriptions. *Hosp Pharm* 2006; 41: 442-454.

9. DeVane CL, Nemeroff CB. 2000 Guide to Psychotropic Drug Interactions. New York, NY: MedWorks Media, LLC; 2000; pp 10-11.
10. Butler MS. The Role of Natural Product Chemistry in Drug Discovery. *J Nat Prod* 2004: 67:2141-2153.
11. Farnsworth NR, Akerele O, Bingel AS, et al. Medicinal Plants in Therapy. *Bull WHO* 1985; 63: 965-981.
12. Newman DJ, Cragg GM, Snader KM. Natural Products as Sources of New Drugs over the Period 1981-2002. *J Nat Prod* 2003; 66: 1022-1037.
13. Chin Y-W, Balunas MJ, Chai HB, Kinghorn AD. Drug Discovery from Natural Sources. *The AAPS Journal* 2006; 8 (2): E239-53.
14. Hamilton A. Medicinal plants and conservation: issues and approaches. UK: International Plants and Conservation Unit, WW-UK. 2003
15. Anon. Plants under siege in Africa. International. CNN.COM/Science & Space; Sept 23 2003.
16. Hoareau L, DaSilva EJ. Medicinal plants: a re-emerging health aid. *Electronic Journal of Biotechnology* [on line]. 15 august 1999, Vol 2, No 2 [Cited 14 July 2005]. Available from http://www.ejbiotechnology.info/content/vol2/issue2/full/2/ ISSN 0717-3458
17. Aketch CA. Preliminary survey of the conservation status of some plants species in Kenya. In: The Status of Some Plants Resources in Parts of Tropical Africa. *Botany 2000: East and Central Africa. NAPRECA Monograph series 2.* Edwards S, Asfaw Z (eds.). Addis Ababa: NAPRECA, Addis Ababa University: 1992; pp 57-65.
18. Mavi S. Medicinal Plants of Zimbabwe. Third NAPRECA Symposium on Natural Products [held in Arusha, Tanzania]. Symposium Handbook. Ethiopia: EMPDA, 1989; p 25.
19. Afolayan AJ, Meyer JJM. Antimicrobial activity of *Helichrysum aureonitens*. Sixth NAPRECA Symposium on Natural Products: Sept 10-15, Kampala, Uganda. Natural Products for Development, Chemistry, Botany and Pharmacology; Extended Abstracts. Ethiopia: EMPDA; 1995; p 89.
20. Fullas F. Economic Aspects of Medicinal Plants in Ethiopia. *Addis Tribune*; 4/15/05.
21. Eisenberg DM, Kessler RC, Foster C, et al. Unconventional medicine in the United States: prevalence, costs, and patterns of use. *New Eng J Med* 1993; 328:246-252.
22. Eisenberg DM, Davis RB, Ettner SL, et al. Trends in alternative medicine use in the United States, 1990-1997. Results of a follow-up survey. *JAMA* 1998; 280:1569-1575.
23. Johnston BA. Prevention Magazine Assesses Use of Dietary Supplements.

HerbalGram 2000; 48:65

24. Barnes BJ, Anderson LA, Phillipson JD. Herbal interactions. *Pharmaceutical J* 2003; 270:118-121
25. Johnston BA. Two-thirds of Canadians say Natural Herbal Supplements Are as Effective as Prescription or Over-the-Counter Remedies. *HerbalGram* 2000; 48:66
26. Marwick C. Growing Use of Medicinal Botanicals Forces Assessment by Drug Regulators. *JAMA* 1995; 273 (8): 607-609.
27. Bazzie KL, Witmur DR, Pinto B, Bush C, Clark J, Deffrenbaugh J JR. National survey of dietary supplement policies in acute care facilities. *Am J Health-Syst Pharm* 2006; 63:65-70
28. Fullas F, Hailemeskel B. The Dilemma of In-patient Dietary Supplement Use. *Natural Health Partners Newsletter* 2002; 1 (15). www.imakenews.com/entrails.
29. Izzo AA, Ernst E. Interactions Between Herbal Medicines and Prescribed Drugs. A Systematic Review. *Drugs* 2001; 61:2163-2175.
30. Fugh-Berman A. Herb-drug interactions. *Lancet* 2000; 355:134-138.
31. Patwardhan B. Traditional Medicine. A Novel Approach for Available, Accessible and Affordable Health Care. WHO Regional Office for South-East Asia; Document no. 17; 27 May 2005; pp 1-46.
32. Miller L. Selected Clinical Considerations Focusing on Known or Potential Drug-Herb Interactions. *Arch Intern Med* 1998; 158:2200-2211.
33. Fugh-Berman A, Ernst E. Herb-Drug Interactions: Review and assessment of report reliability. *Br J Clin Pharmacol* 2001; 52: 587-595.
34. Peng C, Glassman PA, Trilli LE, et al. Incidence and severity of potential drug-dietary supplement interactions in primary care patients. *Arch Intern Med* 1004; 164:630-636.
35. Hailemeskel B, Lee HJ, Tomhe H. Incidence of potential herb-drug interactions among herbal users. ASHP Midyear Clinical Meeting. 2000; Dec; P-267E
36. Philp RB. Herbal-Drug Interactions and Adverse Effects. New York, NY: McGraw-Hill; 2004: p 7.
37. Cupp MJ. Herbal remedies: adverse effects and drug interactions. *Am Fam Physician* 1999; 59: 1239-1244.
38. Zou S, Koh HL, Gao Y, et al. Herbal bioactivation: the good, the bad and the ugly. *Life Sci* 2004; 74(8): 935-968.
39. Blumenthal M. Interactions Between Herbs and Conventional Drugs: Introductory Considerations. *HerbalGram* 2000; 49:52-63.
40. Abebe W. Herbal medication: potential for adverse reactions with analgesic drugs. *J Clin Pharm Ther* 2002; 27: 391-401.
41. _____. An Overview of Herbal Supplement Utilization with Particular Emphasis on Possible Interactions with Dental Drugs and Oral Manifestations. *J Dent Hyg* 2003; 77(1): 37-46

42. Treasure J. Herbal pharmacokinetics: A practitioner update with reference to St. John's wort (*Hypericum perforatum*) herb-drug interactions. 2000; http://www.InteractionReport.org/SJW.pdf
43. Brinker F. Herb Contraindications & Drug Interactions. Sandy, OR: Eclectic Medical Pub; 2001
44. Luyckx VA, Ballantine R, Claaya M, et al. Herbal remedy-associated acute renal failure secondary to *Cape aloes*. *Am J Kidney Diseases* 2002; 39(3): 1-5
45. Kuhn L. Herbal Remedies: Drug-Herb Interactions. *Crit Care Nurse* 2002; 22:22-28.

♣♣♣ Chapter II ♣♣♣

The Nexus Between Ethiopian Herbal Medicines and Conventional Drugs

Traditional medicine has been used in Ethiopia for a long time. Even after the advent of modern medicine, traditional medicine remained, and continues to be the mainstay, *albeit de facto*, healthcare system in the country. Apart from reasons of accessibility and economics, the use of traditional health care is also part of the indigenous culture which has been sustained for hundreds of years. Once restricted to the knowledge domain of traditional healers, indigenous medicine now appears to be trickling into the scientific sphere of Ethiopian healthcare professionals, and other researchers. At various times, multi-disciplinary workshops have been held to highlight the various aspects of traditional medicine, particularly the use of medicinal plants, and draw up strategies to promote and streamline evidence and research-based traditional healthcare.[1,2] The healthy complementarity of traditional medicine and modern medicine has been amply demonstrated in countries like China and India, where the two systems have been used side by side.

On the issue of integration of herbal medicine into official

healthcare, the late pharmacognosist Varro Tyler, who was considered as the conscience for rational herbal medicine had the following to write:

> *"To reach this stage where herbal products of assured quality of effectiveness become integrated into mainline medical treatment, several obstacles must be overcome. The prejudice of currently practicing health-care professionals who did not learn about phytomedicines during their academic programs and, consequently, believe all of them to be ineffective forms a barrier that will prevail for some time. Equally obstinate will be the opinions of some traditional herbalists who believe that unprocessed natural products have an innate superiority and that the mystical aura surrounding herbs will be destroyed by extraction and standardization."*[3]

The above excerpt has universal implication, and is also equally applicable to Ethiopia, although there were other issues addressed in the cited article on the herbal industry in the west, which is lacking in Ethiopia. As it pertains in a broad sense to the integration concept in the African continent, Anokbonggo sums it up as follows:

> *"Exposing medical students to traditional medicine will assist in training a brand of doctors who will be appreciative of their heritage and thus consider it their inherent duty to go all out in identifying the good and bad aspects of African traditional medical practice. It is my belief that the good aspects of the practice could be beneficially used in promoting primary health care delivery of novel drugs on international ranking."*[4]

In the Ethiopian context, Djote has emphasized the need for the educational system in Ethiopia from elementary school all the way up to the college level to devote lessons to teaching students about the properties and potentials of Ethiopian medicinal plants.[5] This approach may indeed be one of the avenues to follow if future generations of Ethiopian physicians, pharmacists and other health workers are to be equipped with knowledge of the basic science of herbal medicine in general, and of Ethiopian traditional medical

heritage, in particular.

A survey of 14 modern health practitioners and 80 traditional medicine practitioners was conducted in Shirka District, Arsi Zone. About 79% of the surveyed modern practitioners had themselves seen a traditional healer (s) at least once in their life time for some kind of treatment, and 71% of these people believed that traditional medicine is indeed important in health care. On the other hand, 28.6% of the modern health practitioners during their practice came across patients who had been referred to them by traditional healers. About 85% of the modern practitioners indicated that they encountered patients who had sought traditional treatment prior to coming to modern health care services. Although 78.6% of the conventional health workers surveyed admitted they prefer modern health care, 86% believed that the two systems should be integrated and that traditional medicine should be investigated scientifically. Likewise, about 97% of the traditional healers stressed the need for training, 98% were willing to collaborate with modern practitioners, and 84% supported the integration of the two types of health systems to improve the health care coverage of the people.[6] Although this study was based on a small practitioner population sample size, it nonetheless points to the complementarity of the two systems. Another survey[7] was carried out in Addis Ababa and Butajira, central Ethiopia. This study found that 90% of the traditional healers (N=44) had no interaction with conventional practitioners. About 27% of the traditional healers felt lack of means of cooperation, and 25% claimed they are undermined or ignored by modern practitioners. Mistrust, lack of interest and geographical distance were some of the barriers mentioned by the traditional healers as reasons for lack of cooperation with their modern counterparts. It is also interesting to note that according to this study about 11% of the 277 traditional formulas used by the traditional healers were of composite nature (compounded from more than one plant species). Considering the apparent lack of cooperation, the use of multi-plant remedies, and the widespread self-medication patterns with pharmaceuticals, the potential for herb-drug interactions and adverse events becomes all the more important.

Ethiopia is endowed with a diverse topography and climatic

conditions, which support the growth of a broad range of vegetation types. It is estimated that there are about 7,000 vascular plant species, of which about 12% are endemic.[8] About 600 plant species have been documented as having been used for medicinal purposes.[9] One estimate puts the total number of medicinal plants close to 1,000.[10,11] Most of the plants used in Ethiopian traditional medicine have not been investigated scientifically. There are about 80,000 people involved is traditional medicine as practitioners, medicinal plant collectors, vendors, or related activities. Presently, there is no industry for botanical products. Recently, several reports on the chemistry, biological activity, and ethnobotany of Ethiopian medicinal plants have been forthcoming. Sustained, multi-institutional and inter-disciplinary concerted efforts to validate, standardize, and mass-produce herbal products in modern dosage forms (tablets, capsules, etc.) are lacking, despite some isolated attempts in that direction.

Although there are no official data to support the contention, a widely held estimate is that about 80% Ethiopians use traditional medicine to treat their illnesses and maintain their health. This percentage appears to hold true also for most developing countries. Nonetheless, it is not certain how many of Ethiopians use modern medicine in conjunction with traditional medicine. There are some scattered and limited published reports which show that a sizable number of people use both systems.

According to a 1982-83 rural health survey report, more than half of health service seekers relied on traditional healers, or self treatment. In Addis Ababa, it was reported that as many as 26% of a study population were found to have used traditional medicine.[12]

In 1980, a survey of 149 patients, who were seen in the Black Lion Hospital and St. Paul's Hospital, both in Addis Ababa, was reported. The study showed that 52% of the male patients, and 75.6% of the female patients admitted to taking traditional medicine in the past, while 36% of the males and 52.8% of the females had taken traditional medicine for the diseases they were admitted to the two hospitals. According to the study, 50% of all patients used traditional medicine for *mitch* (undefined medical affliction, characterized by fevers, chills and possibly headache), while 45.5% used *dingetegna*

(*Taverniera abyssinica*), 19.1% used traditional medicine for *ye wef beshita* (jaundice), and 89% had used traditional medicine for taeniasis. Almost in all cases, the botanical remedies were self-prescribed. Only in the case of severe illnesses such as hepatitis, traditional healers were consulted.[13]

In 1983, a survey of 339 patients was conducted at Black Lion and St. Paul's Hospitals. Out of these patients, 216 were from Addis Ababa, while 120 came from outside of Addis Ababa. A total of 146 patients were admitted to the medical wards of these hospitals, and a total of193 were seen as outpatients at both facilities combined. About 85% of the patients reported to have used traditional medicine in their life time, whereas 50.4% revealed using traditional medicine in the year prior to the survey. About 24% admitted to using traditional treatment for the illnesses for which they sought treatment in the hospitals.[14] In an earlier study, Abdulkadir has shown the prevalence of intake of local tanecidical remedies such as **kosso** (*Hagenia abyssinica*), **enkoko** (*Embelia schimperi*) **metere** (*Glinus lotoides*), **bisana** (*Croton macrostachys*), and **ketechemo** (*Myrsine africana*) among 184 diabetic and 235 non-diabetic patients. The study was conducted in a referral clinic and at the Black Lion Hospital in Addis Ababa. The incidence of exposure to these local botanical remedies was about 79%, and about 54% of all patients were found to be regular consumers of the taenicidal herbs.[15]

There are only a few recently published studies on the extent of the use of traditional medicine in the country. In 1992, a survey of 113 patients was conducted in Jimma Hospital in southwestern Ethiopia. According to the study, 27% of the rural patients and 12% of the urban patients reported that they had used traditional medicine.[16] Another study carried out in 1999 in Gondar, Koladeba, and Debark towns involved a relatively larger population size. A total of 10,170 patients were surveyed. The study revealed that 1,190 patients (11.7%) had illnesses two weeks prior to the study. Of these, 324 (27.2%) patients self-medicated for their illnesses, and 164 (13.8% of the total 1,190 who reported illnesses) used modern drugs, while 109 (9.1% of the total) took home remedies. The study also showed that 51 patients (4.3% of the total) treated themselves with

traditional medicines provided or recommended by traditional healers. The rest of the patients (534, i.e. 45%) were treated in health institutions, while 332 patients didn't seek any kind of treatment.[17] A national 1982-83 rural health survey reportedly indicated that more than 50% of the people surveyed used the services of traditional healers, or self-treated.[18]

From the above studies, it is evident that many people use traditional medicine as well as modern medicine. The use of botanicals is a major treatment modality in Ethiopian traditional medicine. It is quite conceivable then that people may use herbs and conventional medications concurrently. If the use of both systems is not closely monitored, the therapy of patients may be compromised, because of potential undesired clinical effects arising from possible herb-drug interactions.

The Case of P450 Polymorphisms in Ethiopians

The make-up of the drug metabolizing P450 enzyme system in humans, and the types and variations of the constituent metabolizing isozymes determine the nature and extent of many herb-drug interactions. This phenomenon, although not well studied, is important in influencing potential herb-drug interactions that arise from pharmacokinetic (especially metabolic pathway) effects.

Some P450 enzymes occur in polymorphic forms, which are found in small percentage of populations. These population groups have mutant genes which alter the activity of the enzymes, usually by diminishing or abolishing the activity. Polymorphisms in isozymes CYP1A2,[19] CYP2C9[20] and CYP2D6[21-23] are exhibited by Ethiopians, due to their unique genetic dispositions (see Appendix IV for examples of the drugs metablolized by these enzymes).

The P450 isozyme CYP1A2 is involved in the metabolism of about 5% of commonly used drugs such as paracetamol, theophylline, caffeine, and clozapine. Four variants (halotypes) of CYP1A2 have been found in Ethiopians, CYP1A2*1A, CYP1A2*1F, CYP1A2*1J, and CYP1A2*1K with a frequency of 39.9, 49.6, 7.5 and 3.0%, respectively. The frequencies of the variants 1J (5.9%) and 1K (3.6%) in Saudis are comparable with those of Ethiopians,

whereas in Spaniards both are significantly lower, with a frequency of 1.3% for 1J, and 0.5% for 1K. In general, people who have CYP1A2*1K have shown decreased CYP1A2 activity in vivo.[19]

There is also a unique distribution of CYP2C9 alleles in the Ethiopian population. The cytochrome P450 2C9 (CYP2C9) catalyzes the metabolism of many drugs such as warfarin, tolbutamide, losartan, torsemide and NSAIDs. The three alleles known to occur in Ethiopians are CYP2C9*1, CYP2C9*2, and CYP2C9*3. Of these, the CYP2C9*2 allele frequency among Ethiopians is lower than in Caucasians, but higher than in African Americans. The frequency of CYP2C9*3 among Ethiopians is comparable with that found in Japanese and Chinese populations, but is much higher than in African Americans. Therefore, the Ethiopian population has a unique relative distribution of the CYP2C9 alleles which is not similar to any other population group.[20]

In their study, Scordo et al. conclude that CYP2C9 polymorphism among different racial groups might contribute to optimization of therapy with certain drugs.[20] Although not studied in Ethiopians, CYP2C9 polymorphism may play some role in herb-drug interactions.

Another important group of enzymes prevalent in Ethiopians, and which have an important role in drug metabolism, and therefore in herb-drug interactions are the CYP2D6 isozymes. Over 40 allelic variants of this enzyme have been identified. Although it accounts for less than 2% of the total CYP450 liver enzyme content, CYP2D6 is responsible for the metabolism of a large number of drugs. CYP2D6 polymorphism (the occurrence of SNP's [single nucleotide polymorphisms], alleles, and multiple gene copies) is a function of geographical origin, race, environment, and dietary habits of a given population. Depending on their CYP2D6 make-up, individuals are divided into poor (no enzyme activity), intermediate (reduced enzyme activity), extensive ('normal" enzyme activity), and ultra-rapid (higher than normal) metabolizers. These groupings are phenotypes, since environmental factors can influence how CYP2D6-dependent drugs are metabolized. Defect alleles result in poor

metabolizers, while duplicated or multi-duplicated active genes result in ultra-rapid metabolizers.[22,23]

Among Africans, Ethiopians are known to have higher CYP2D6*10 frequencies, lower CYP2D6*17 frequencies, and extremely high frequencies of gene duplications, which are more than any other population groups. The higher CYP2D6*10 frequencies have been attributed to the geographical location of Ethiopia, the predominant migration from Africa outward, and the later trade routes hundreds of years ago from Far East, bringing admixture of the Asian allele (CYP2D6*10B, common in the Chinese) into Ethiopia. In comparison to Caucasians, Oriental and other Black populations, Ethiopians are genetically different with respect to the constitution of their CYP2D6. About 29% of Ethiopians carry alleles with duplicated or multi-duplicated CYP2D6 genes, indicative of their ultra-metabolizing status. The corresponding figures are 1% for the Chinese, and 4.8% for sub-continental Indians.[23]

Poor metabolizer patients who are treated with drugs that are extensively metabolized by CYP2D6 enzymes are at an increased risk of experiencing toxicity with standard dosing, while ultra-rapid metabolizers may not achieve therapeutic levels with standard dosing. Exception to this is when a pro-drug is converted into its active form by CYP2D6, in which case poor metabolizers would get no benefit from the drug, while ultra-metabolizers may experience toxicity due to accumulation of the active metabolite in the blood.[24]

It is evident that P450 polymorphism influences the way and to what magnitude, drugs and herbs (and their constituents) are metabolized in the body. This is especially true for patients who take herbal products and conventional drugs simultaneously. To what extent these phenomena occur and affect treatment outcomes in patients in Ethiopia is not known. However, in a country where self-medication with modern drugs is widespread, and where monitoring of herb-drug interactions is virtually non-existent, the true extent of these interactions and their effect on treatment outcomes can only be a matter of speculation. Given the uniqueness of the way drugs are metabolized by Ethiopians, a base-line study is needed to determine the magnitude and extent of herb-drug interaction problems.

Integration of Herbal Medicines and Conventional Drugs in Ethiopia

Although the concurrent use of modern pharmaceutical agents and traditional herbal medicines dates back to the turn of the last century, serious scientific efforts to investigate herbal remedies did not begin until recently perhaps with the establishment in 1979 of a Coordinating Office for Traditional Medicine (later Department of Traditional Medicine) within the Ministry of Health. This effort was spurred by Proclamation No. 127/1977 which favored the promotion of traditional drugs along with modern ones. The Department set for itself lofty goals of not only a phytochemical screening program, but also among others clinical evaluation of traditional health practices and surgical procedures. At that time, given the level of staffing, physical space, laboratory facilities, and funding, this was a rather ambitious endeavor.[12] The major source of funding for the Department was coming from the World Health Organization (WHO). Despite continuous funding, impact-targeted outputs were not achieved [25] Later, the department was upgraded to the Department of Drug Research within the set-up of the Ethiopian Health and Nutrition Research Institute. One major accomplishment of the Department is the documentation of over 600 medicinal plant species, along with their folkloric uses. For a great number of these plants, their chemical and biological profiles have also been documented.[9]

Various reasons have been advanced for the popularity of traditional medicine, which include: (a) more efficacy, (b) less side effects, (c) low cost, and (d) more accessibility. Each of these reasons may have some merits. Justification aside, the belief in the usefulness of traditional medicine and medicinal plants is deeply ingrained in the local cultures and religions of millions of Ethiopians, especially in the rural areas. Integration of traditional and modern healthcare systems, and not exclusivity of one in the preference to the other, appears to be the logical course to follow in order to extract the best out of both systems.

The main impediments to integration of traditional healthcare and modern medicine are that (a) traditional medicine practitioners

and lay people to some extent believe in secrecy, for example the claim that traditional medicine fails if the procedure, or the mixing (compounding) of plant remedies is revealed to other people; (b) modern health practitioners tend to dismiss wholesale traditional medicine, citing lack of science behind it; (c) many multi-plant species formulas, whose ingredients are multiple and not standardized makes the remedies not amenable to scientific evaluation.[26]

Generally, the difficulties of integration are centered around, among others, the notion that certain ailments are treatable only by traditional medicine, the rivalry among practitioners of the respective traditional and modern systems, and the difference in the philosophy of disease definition. However, the experiences of countries such as Thailand, China, and India bear out the fact that the differences of the two systems can be reconciled.[27] Integration involves structural, functional, and legal incorporation of traditional and modern medicine systems into the official health care system. Various approaches have been proposed towards the gradual road to integration, from mere tolerance by passive recognition of traditional medicinal practitioners and their practice to broad legalization without licensure requirements. A more complete approach is legal and structural incorporation which would require enforceable training, licensure and supervision.[26] One area that may pose serious problems in the process of integration is the use of herbal medicine in lieu of, or concurrently with modern drugs. The need of laying down a general knowledge foundation of herb-drug interactions, and recognition of the latter's possible impact on treatment outcomes in patients in Ethiopia appear to be timely and appropriate.

References

1. Abebe D., ed. Proceedings of the Workshop on Development and Utilization of Herbal Remedies in Ethiopia. Addis Ababa: University Printing Press; 1996.
2. Zewdu M, Demissie A, eds. Conservation and Sustainable Use of Medicinal Plants in Ethiopia (Proceedings of National Workshop). Addis Ababa: Institute of Biodiversity Conservation and Research; May 2001
3. Tyler VE. Phytomedicines: Back to the Future. *J Nat Prod* 1999; 62:1589-1592

4. Anokbonggo WW. The Role of African Traditional Medicine in Health-Care Delivery alongside Modern Medicine. In: Plants Used in African Traditional Medicine as Practiced in Ethiopia and Uganda, Botany 2000: *NAPRECA Monograph Series No. 5*. Edwards S, Zemede A (eds). Addis Ababa, Ethiopia: NAPRECA, Addis Ababa University; pp 25-35
5. Djote M. The role of educational institutions and health professionals in the better use of medicinal plants. In: Conservation and Sustainable Use of Medicinal Plants in Ethiopia (Proceedings of National Workshop). Zewdu M, Demissie A (eds). Addis Ababa: Institute of Biodiversity Conservation and Research; May 2001; pp188-197
6. Addis G, Abebe D, Genebo T, Urga K. Perceptions and practices of modern and traditional medicine in Shirka District, Arsi Zone, Ethiopia. *Ethiop J Health Dev* 2002; 16(1):19-29.
7. Gedif T, Hahn H-J. Herbalists in Addis Ababa and Butajira, Central Ethiopia: Mode of service delivery and traditional pharmaceutical practice. *Ethiop J Health Dev* 2002; 16(2):191-197.
8. Fullas F. Ethiopian Traditional Medicine; Common Medicinal Plants in Perspective. Sioux City, IA: 2001; p x.
9. Abebe D. Preface. In: Proceedings of the Workshop on Development and Utilization of Herbal Remedies in Ethiopia. Abebe D (ed.). Addis Ababa: University Printing Press; 1996; pp iv-viii.
10. Fullas F. Economic Aspects of Medicinal Plants in Ethiopia. *Addis Tribune*; 4/15/05.
11. Anon. Highlights of People and Biodiversity of Ethiopia. People and Biodiversity. The International Society of Ethnobiology (ISE) 8th International Congress. Addis Ababa, Ethiopia; 16-20 Sept 2002; p77.
12. Shiferaw M. The Role of Health Professional in the Development of Traditional Medicine. In: Proceedings of the Workshop on Development and Utilization of Herbal Remedies in Ethiopia. Abebe D (Ed). Addis Ababa: Addis Ababa University Printing Press; 1996; pp 15-18.
13. Abebe M, Abdulkadir J. Incidence of traditional drug intake by Ethiopian patients. *Ethiop Med J* 1980; 18: 134
14. Abdulkadir J. Utilization of traditional medicine among hospital patients in Addis Ababa. *Ethiop Med J* 1986: 24:87-91.
15. Abdulkadir J. Intake of traditional taenicidal drugs among diabetics and non-diabetics. *Ethiop Med J* 1979: 17:75-80.
16. G-Mariam A, Lemma F, Alemu Y. Utilization of traditional medicine among inpatients in Jimma Hospital. *Ethiop J Health Dev* 1993; 7(2):119.
17. Abula T, Worku A. Self-medication in three towns in Northwest Ethiopia. *Ethiop J Health Dev* 2001; 15(1):25-30.
18. Gedif T, Hahn H-J. Herbalists in Addis Ababa and Butajira, Central Ethiopia.: Mode of service delivery and traditional pharmaceutical practice. *Ethiop J Health Dev* 2003: 16(2):191-197.

19. Aklilu E, Carrillo JA, Makonnen E, et al. Genetic Polymorphism of CYP1A2 in Ethiopian Affecting Induction and Expression: Characterization of Novel Haplotypes with Single-Nucleotide Polymorphisms in Intron 1. *Mol Pharmacol* 2003; 64:659-669.
20. Scorda MG, Aklilu E, Yasar U, et al. Genetic polymorphism of cytochrome P450 2C9 in a Caucasian and a black African population. *Br J Clin Pharmacol* 2001; 52:447-450.
21. Aklilu E, Persson I, Bertilsson L, et al. Frequent distribution of ultrarapid metabolizers of debrisoquine in an Ethiopian population carrying duplicated and multiduplicated functional CYP2D6 alleles. *J Pharmacol Exp Ther* 2001; 278(1): 441-446.
22. Ingelman-Sunberg M. Genetic polymorphisms of cytochrome P450 2D6 (CYP2D6); clinical consequences, evolutionary aspects and functional diversity. *Pharmacogenomics J* 2005; 5:6-13.
23. Bradford LD. *CYP2D6* allele frequency in European Caucasians, Asians, Africans and their descendants. *Pharmacogenomics* 2002; 3(2): 229-243.
24. Gates BJ, Davies NM. *AmpliChip* for Cytochrome P-450 Genotyping: The Epoch of Personalized Prescriptions. *Hosp Pharm* 2006; 41: 442-454.
25. Mwambaze WC. WHO partnership in the development and utilization of herbal remedies in Ethiopia. *In*: Proceedings of the Workshop on Development and Utilization of Herbal Remedies in Ethiopia. Abebe D (ed.). Addis Ababa: University Printing Press; 1996; pp 26-27.
26. Abebe D. The role of Medicinal Plants in Health Care Coverage of Ethiopia: The Possible Benefits of Integration. In: Conservation and Sustainable Use of Medicinal Plants in Ethiopia (Proceedings of National Workshop). Zewdu M, Demissie A (Eds). Addis Ababa: Institute of Biodiversity Conservation and Research; May 2001; pp 7-21.
27. Kassaye M. Integration of Traditional Medicine with Modern Health Care Services. In: Proceedings of the workshop on Development and Utilization of Herbal remedies in Ethiopia. Abebe D (Ed). Addis Ababa: Addis Ababa University Printing Press; 1996; pp 10-14.

♣♣♣ Chapter III ♣♣♣

Monographs of Interactions of Ethiopian Herbal Medicines and Spices with Conventional Drugs

In this chapter, each monograph has sections which deal with herb-drug interactions and clinical management of interactions. No attempt has been made to classify the interactions, based on the seriousness of the interaction, or the strengths of data. All documented or suspected interactions have been included. For more insight, the references (and the original references cited therein) may be consulted. Some interactions are based on human studies, while others are derived from animal studies, or in vitro models. Yet, other interactions are based on theoretical predictions made from the nature of the respective constituents, whose pharmacological actions are well established in earlier studies. Wherever provided, the clinical interventions for the management of interactions address only part of the interactions. It is the health provider's clinical judgement to find alternative treatment, monitor the therapy, or change the times of administration.

The following abbreviations have been used for the corresponding vernacular names:

A= *Amarinia*
G=*Guraginia*

Gam=*Gamonia*
Had=*Hadyania*
Kef=*Kefinia*
Kemb=*Kembatinia*
Me=*Me'eninia*
O= *Orominia*
S=*Somalinia*
T=*Tigrinia*
Wel=*Welayitinia*

Aloes

Local (vernacular) Name (s): Eret (A), merare (A) [for some species]; argeessa, heejersa (O) [for several species]; sand're, arret, zaber, aray (T) [for various species].

Scientific Name: *Aloe* spp

Family: Liliaceae

Common Names: Aloe juice, Aloe latex, burn plant, elephant's gall, Hsiang-Dan, lily of the desert, Lu-Hui, miracle plant, plant of immortality

Medicinal Uses:

In Ethiopia: Sap, orally for ascariasis, and heart disease; juice, against malaria; root, for miscarriage; charred plant powder mixed with another plant for rectal prolapse; sap, topically for eye disease (infection); roots, for wound and baldness;[1] roots, orally for bile problems.[2]

Outside of Ethiopia: Latex/juice, orally as a laxative or cathartic, for seizures, asthma, colds, ulcer, bleeding, amenorrhea, colitis, depression, diabetes, glaucoma, multiple sclerosis, hemorrhoids, peptic ulcers, varicose veins, bursitis, arthritis, and vision problems; aloe gel, orally as a general tonic (cleanser, anesthetic, antipyretic, moisturizer, vasodilator, ant-inflammatory agent, promoter of cell proliferation), for gastroduodenal ulcers, diabetes, and asthma. Topically for burn, wound healing, and cold sores.[3]

Herb-Drug Interactions:

Cardiac glycosides (e.g., digoxin), antiarrythmic drugs: Long-term use of aloes as a stimulant laxative may deplete the body of potassium, thereby potentiating the effects of cardiac glycosides, and antiarrythmic drugs such as quinidine.[4]

Potassium loss due to aloes use is partly in the feces, and partly as secondary renal effect associated with sodium loss. Patients taking aloes for more than 1-2 weeks may experience the signs and symptoms of hypokalemia, which includes lethargy, muscle cramps, headaches, paresthesias, tetany, peripheral edema, polyuria, breathlessness, and hypertension. Concurrent use with digoxin may cause signs and symptoms of digoxin toxicity, including anorexia, nausea, vomiting, diarrhea, weakness, visual disturbances, and ventricular tachycardia.[5]

Glyburide (glibenclamide): In a clinical trial, when one tablespoonful (15 ml) of aloe juice was given orally in the morning and at bedtime to 36 diabetic patients for 42 days, the hypoglycemic effect of glyburide (glibenclamide) was increased. In another study, hypoglycemic effect was observed when aloe juice alone was given to 36 diabetic patients at the same dose, frequency, and duration.[4]

Hydrocortisone acetate: As demonstrated in human studies, when applied topically with polyethylene oxide gel, aloe gel improved the rate of healing. In a study on mice, application of aloe gel as a vehicle for hydrocortisone acetate topical preparation improved anti-inflammatory effect.[6]

Oral drugs: Aloe sap reduces absorption of oral drugs, due to a decrease in gastrointestinal transit time.[6]

Sevoflurane: Aloe vera gel has been associated with massive intraoperative bleeding during surgery. According to a case report, concomitant use of sevoflurane and aloe vera tablet may have ant-platelet effect, thus leading to bleeding.[7]

Thiazide diuretics and corticosteroids: Potassium loss can be worsened with potassium-wasting thiazide diuretics and corticosteroids.[4]

Clinical Management:

Patients taking digoxin should be advised to avoid concomitant use of aloes. If digoxin toxicity occurs, potassium should be supplemented immediately, while discontinuing the use of aloes.[5] Diabetic patients taking aloes should be monitored for blood glucose levels.[7] Patients should also be counseled to avoid aloes at least one week prior to surgery.[5]

References:

1. Fullas F. Ethiopian Traditional Medicine: Common Medicinal Plants in Perspective, Sioux City, IA, USA; 2001, pp 31-32.
2. Abate G. (Demissew S, ed.). *Etse Debdabe* (Ethiopian Traditional Medicine). Addis Ababa, Ethiopia: Biology Department, Science Faculty, Addis Ababa University; 1989; p 100.
3. Jellin JM, Gregory P, Batz, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database*. 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000; pp 35-37.
4. Blumenthal M. Interactions Between Herbs and Conventional Drugs: Introductory Considerations. *HerbalGram* 2000; 49:52-63.
5. Klasco RK (Ed.). DRUG-REAX® System. Thomson Micromedex. Greenwood Village, CO: Thomson Healthcare, Inc. (2006 Edition).
6. Brinker F. Herb Contraindications and Drug Interactions. Third Edition. Sandy, OR: Eclectic Medical publications, 200; p 29.
7. Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY: Church Street Books, 2005; pp 21-22.

Anise

Local (vernacular) name (s): *Ensilal* (A)

Scientific name: *Pimpinella anisum* L.

Family: Umbelliferae (Apiaceae)

Common names: Anise, anise fructus, anise seed, phytoesterogen, semen anisi, sweet cumin

Medicinal Uses:

In Ethiopia: The vernacular name "ensilal" is used for a variety of medicinal plants such as *Anethum graveolens*, *Cuminum cyminum*. and *Foeniculum vulgare*. Therefore, it is not certain what medicinal uses are actually attributed to *P. anisum* in Ethiopia.[1]

Outside of Ethiopia: Orally, for dyspepsia, as a pediatric antiflatulent and expectorant; topically, against lice, scabies and psoriasis. Other uses: to increase lactation, induce menstruation, facilitate birth, increase libido, for male claimacteric,[2] common cold, cough, bronchitis, fevers, colds, inflammation of the mouth and pharynx, liver and gallbladder complaints, loss of appetite, tendency to infection, internally and externally for catarrh of the respiratory tract.[3]

Culinary Uses in Ethiopia:

Ground seeds to flavor *wot*, and in the preparation of alcoholic beverages.[1]

Herb-Drug Interactions:

Anti-convulsant drugs: The essential oil constituents of anise have anti-convulsant effect. It is not known, however, if concurrent use with anti-convulsant drugs has additive effect.[4]

Anti-platelet agents/thrombolytic drugs: Anise may increase the risk of bleeding, or potentiate the effects of anti-platelet agents. Concurrent use of anise and thrombolytic agents may also

result in increased risk of bleeding.[5]

Diuretics: Anise seed decreases urine to water intake ratio (antidiuretic effect), without significant effect on water intake, which may interfere with diuretic drug action.[4]

Estrogen replacement therapy/oral contraceptives: Anise contains anethole which has estrogenic activity. However, the effect of concurrent use with hormone replacement therapy is not known.[4]

Insulin/Oral hypoglycemic agents: Essential oil of anise increases glucose absorption in the jejenum, which theoretically increases blood glucose levels, thus counteracting the effects of hypoglycemic medications.[4]

Iron: Extract of anise for beverage use enhances absorption of iron.[4]

Monoamine Oxidase Inhibitors (MAOIs): Although MAOIs increase catecholamines, the effect of concurrent use with anise is not known.[4] Excessive use of anise may interfere with the action of MAOIs and hormone therapy.[2]

Clinical Management:

Caution is advised if patients are on anticoagulants, anti-platelet drugs, thrombolytic agents, and low molecular weight heparins, and take anise at the same time. They should also be advised to maintain a constant amount of anise intake. Signs and symptoms of increased bleeding should be monitored.[5] Alternatively, anise consumption should be avoided when patients are on thrombolytic, anti-coagulant, anti-platelet, or low molecular weight heparin therapies. Patients who take anise should also be monitored for blood glucose levels, while they are on anti-diabetic medications.[4]

References:

1. Fullas F. Spice Plants in Ethiopia: Their Culinary and Medicinal Applications. Sioux City, IA, USA; 2003, pp 120-123.
2. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database.* 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 68-69.
3. Gruenwald J, Brendler T, Jaenicke C. (Scientific Eds.). PDR for Herbal

Medicines. 1st ed. Montvale, NJ: Medical Economics Company; 1998; pp 1036-1037.

4. Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY: Church Street Books, 2005, pp 26-27.

5. Klasco RK (Ed.). DRUG-REAX® System. Thomson Micromedex. Greenwood Village, CO: Thomson Healthcare, Inc. (2006 Edition).

Basil

Local (vernacular) names: Besobila, adjuban, hulkot, zakakewe(A);
kasse, kefo, kandama, urgo, zahahene (O);
sessak, seseg (T); rehan (S); ye fyel zqaqbe (A; for *Ocimum suave*);
dama kese (A; for *O. lamifloium*)

Scientific name: *Ocimum basilicum* L.

Family: Labiatae or Lamiaceae

Common names: Basil, common basil, garden basil, St. Josephwort, sweet basil

Medicinal Uses:

In Ethiopia: Leaf (*O. lamifolium*) for pyrexia; leaf (*O. suave*) for *nausea,*[1] *Ocinum* sp., for malaria, headache, and as an insect repellant[2]

Outside of Ethiopia: For intestinal parasites, congestive heart failure, alcoholism, depression, as a diuretic, appetite stimulant, digestive aid, for cramps, nausea, constipation and excess gas; topical preparations for wound healing, itching and swelling from snake-bites, ringworm, warts, throat inflammation, and head cold (as leaf steam inhalation).[3]

Culinary Uses in Ethiopia:

Fresh and dried flowers and leaves in the preparation of *wot,* and a multi-ingredient red pepper, in green pepper paste (*tiqur azmud awaze*), red pepper paste, spiced oil, and spiced hot powdered peas (*mitn shiro*).[4]

Herb-Drug Interactions:

Drugs that are substrates of P450 isozymes: Constituents of sweet basil, including 1,8-cineole and eugenol induce P450 enzymes, which may decrease serum levels of drugs that are

substrates of these enzymes.[5]

The following interactions have been reported for the closely related species *Ocimum sanctum* (Holy Basil, Sacred Basil).

Anticoagulants and other drugs that increase the risk of bleeding: Fixed oil of this herb increases clotting time and possibly may inhibit platelet aggregation.[6]

Anti-tubercular drug: Sacred basil leaf extract decreases anti-tubercular drug-induced hepatotoxicity.[3]

Aspirin: The herb decreases aspirin-induced gastric ulcers.[6]

Bromocriptine: Ethanolic extract of *O. sanctum*, when combined with bromocriptine, exhibits a synergetic effect, which suggests that the herb may have a D_2 agonist activity.[6]

Indomethacin: The oil component enhances cutaneous absorption of indomethacin.[5]

Insulin/Oral hypoglycemic agents: When used with insulin or hypoglycemic agents, the plant may further lower blood glucose levels.[6]

Isoproterenol: It is cardioprotective against isoproterenol-induced myocardial infarction and necrosis.[6]

Pentobarbital and pentobarbitone: An extract of the plant is reported to increase lost reflex time induced by pentobarbital. The fixed oil constituent increases pentobarbitone-induced sleep time.[6]

Thyroid medications: When used with thyroid medications, sacred basil extract decreases T_4 levels.[6]

Clinical Management:

Patients on insulin and oral hypoglycemic agents, and who ingest basil at the same time should be monitored for blood glucose levels.[6] Patients should also be monitored for other effects which may be diminished or enhanced by co-administration of basil and the drugs mentioned in the above section.

References:

1. Tadesse M, Demissew S. Medicinal Ethiopian Plants: Inventory, Identification, and Classification. In: Plants Used in African Traditional Medicine as Practiced in Ethiopia and Uganda, Botany 2000: *NAPRECA Monograph Series No. 5*. Edwards S, Zemede A (eds). Addis Ababa, Ethiopia: NAPRECA, Addis Ababa University; 1992, pp 1-19.
2. Jansen PCM. Spices, Condiments and Medicinal Plants in Ethiopia, their Taxonomy and Agricultural Significance. Wageningan:PUDOC;1981; p 95.
3. Peirce A. The American Pharmaceutical Association Practical Guide to Natural Medicines. New York: Stonesong Press; 1999; p 64.
4. Fullas F. Spice Plants in Ethiopia: Their Culinary and Medicinal Applications. Sioux City, IA, USA; 2003, pp 114-119
5. Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY: Church Street Books, 2005, pp 308-309.
6. *Ibid*. pp 279-280.

Black mustard

Local (vernacular) names: Senaficth (A; T);
midan, raffu,senafitcha (O)

Scientific name: *Brassica nigra* L. var *abyssinica* A. Br.

Family: Cruciferae or Brassicaceae

Common names: Black mustard

Medicinal Uses:

In Ethiopia: Leaf for heart failure;[1] other uses: as an abortifacient, for abscess dressing, amoebic dysentery, bloating, constipation, flatulence, indigestion, stomachache, and wound.[2]

Outside of Ethiopia: Oil, topically for common cold symptoms including pulmonary congestion, rheumatism, arthritis, as a counterirritant, and for aching feet (as a foot bath); seed, topically as a poultice for bronchial pneumonia, pleurisy, arthritis, lumbago, aching feet, rheumatism, and a counterirritant; orally, as an emetic, diuretic, and appetite stimulant.[3]

Culinary Uses in Ethiopia:

As an ingredient in *siljo* (a popular dish during Lent season).[1]

Herb-Drug Interactions:

Antacids, H_2-antagonists, or proton pump inhibitors: Theoretically, due to claims that mustard seed and oil increase stomach acid, mustard might interfere with the actions of antacids, H_2-antagonists, or proton pump inhibitors.[3] These effects may be due to the irritant principle isothiocyanate, which is released into the guts from mustard.[4]

Anticoagulants: Since the genus *Brassica* contains vitamin K, it may antagonize the effects of warfarin. Variable intake may compromise the effects of anticoagulants.[5]

CYP1A2: *Brassica* spp decrease the activity of CYP1A2,

which increases the serum levels of drugs metabolized by this isozyme.[5]

Thyroid Replacement Therapy: Many of the *Brassica* spp contain glucosinolates which are goitrogenic. Excessive consumption of *Brassica* spp may thus alter the absorption of thyroid hormone in the GI tract.[5]

Clinical Management:

If patients have to take *Brassica* herbs, they must maintain a constant intake to avoid fluctuation in dosing and therefore the therapeutic effects of most of the drugs.[5]

References:

1. Fullas F. Spice Plants in Ethiopia: Their Culinary and Medicinal Applications. Sioux City, IA, USA; 2003, pp 55-58.
2. Abate G. (Demissew S, ed.). *Etse Debdabe* (Ethiopian Traditional Medicine). Addis Ababa, Ethiopia: Biology Department, Science Faculty, Addis Ababa University; 1989, p 190.
3. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database*. 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 138-140.
4. Brinker F. Herb Contraindications and Drug Interactions. Third Edition. Sandy, OR: Eclectic Medical publications, 2001, pp 151-152.
5. Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY: Church Street Books, 2005, p 99.

Black and white pepper

Local (vernacular) names: Qundo berbere (A)

Scientific name: *Piper nigrum* L.

Family: Piperaceae

Common names: Black pepper, blanc poivre, kosho, pepe, pepper, pepper extract, peppercorn, pepper plant, pepper, pfeffer, pimenta, poivre, poivre noir, white pepper.

Medicinal Uses:

In Ethiopia: As an ingredient in multi-component preparation for mental illness.[1]

Outside of Ethiopia: Orally, for stomach disorders, digestive problems, bronchitis, cancer; white pepper, for stomachache, malaria and cholera; topically for neuralgia, scabies, and as a counterirritant.[2]

Culinary Uses in Ethiopia:

In the preparation of powdered pepper (*afrinj*), to spice dried meat, barley meal (*chiko*) and other popular dishes.[1]

Herb-Drug Interactions:

Benzamphetamine and aminopyrine: When given at a dose of 100 mg/kg given 1 hour prior, piperine (a major constituent of *P. nigrum*) diminished the metabolism of benzamphetamine and aminopyrine.[3]

Capsaicin: It has been demonstrated that cross-tachyphylaxis occurs with piperine and capsaicin.[3]

Cytochrome P450 Isozymes: *P. nigrum* suppresses the expression of CYP2E1, and enhances the expression of CYP2B and CYP1A. Therefore, the metabolism of drugs which are substrates of these enzymes may be altered. Piperine has also been shown to be a non-specific inhibitor of P450 in rats. Hot pepper has been shown to

increase CYP2A6 activity in human volunteers, but not other P450 enzymes.[4]

Ethylmorphine: In vitro test has shown that piperine is a non-specific inhibitor of ethylmorphine and 7-ethoxycoumarin via inhibition of mixed function oxidases and different cytochrome P-450 forms.[3]

Hexobarbital/Zoxazolamine: When piperine was dosed at 5 mg/kg as a pre-treatment in rats, hexobarbital sleeping time was prolonged, while at a dose of 2.5 mg/kg, zoxazolamine paralysis time increased.[3]

Indomethacin: Piperine is protective against indomethacin-induced ulcer.[4]

β-lactam antibiotics: Piperine, an alkaloid in black pepper, enhances the bioavailabilty of β-lactam antibiotics.[4]

Phenytoin: When used concomitantly with phenytoin, black pepper speeds absorption of the latter, and slows its excretion, thus in effect increases the serum dilantin levels.[2] Concomitant intake of phenytoin and piperine by 5 male humans resulted in a more rapid and complete absorption of phenytoin. Piperine has also been shown to increase intestinal cell permeability in vitro.[3]

Propranolol/theophylline: If administered with propranolol, it speeds absorption and increases serum concentration of propranolol.[2] When 20 mg piperine was administered to 12 non-smokers daily for seven days along with propranolol or theophylline, both drugs reached significantly greater serum concentrations[3].

Rifampicin/sulfadiazine/tetracycline/phenobarbital: In human studies, at 1 to 3 mg dose levels, piperine has also been shown to increase blood levels of rifampicin, sulfadiazine, tetracycline, and phenobarbital when used concurrently.[3]

Thyroid replacement therapy: Piperine lowers both T_3 and T_4 levels.[4]

Clinical Management:

All drugs listed above should be closely monitored when they are used in conjunction with black and white pepper, and if necessary doses or dosing times should be adjusted.

References:

1. Fullas F. Spice Plants in Ethiopia: Their Culinary and Medicinal Applications. Sioux City, IA, USA; 2003, pp 127-129.
2. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database*. 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 141-142.
3. Brinker F. Herb Contraindications and Drug Interactions. Third Edition. Sandy, OR: Eclectic Medical publications, 2001, pp 41-42.
4. Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY: Church Street Books, 2005, pp 51-52.

Black seed

Local (vernacular) names: Tiqur azmud (A); habasudu, abousada, guji guracha, gurati, gura (O); aaf (Kef), awoseta (T); awesda (A; G; T); karesa sawo (Gam).

Scientific name: *Nigella sativa* L.

Family: Ranunculaceae

Common names: Ajenuz, barraka, black caraway, black cumin, black seed, charnushka,Comhino Negro, fitch, 'love in the mist,' fennel flower, nutmeg flower, Roman-coriander

Medicinal Uses:

In Ethiopia: For headache; to induce abortion;[1] seeds, for stomachache.[2]

Outside of Ethiopia: Ground seeds as a poultice for inflammatory ailments such as rheumatism, headache and certain skin conditions, as a vermifuge, for digestive disorders, respiratory ailments and cancer[3]; orally, for gas, colic, diarrhea, dysentery, constipation, hemorrhoids, respiratory conditions such as asthma, allergies, cough, bronchitis, emphysema, flu, and congestion, as an antihypertensive, immunoprotectant, contraceptive, for stimulation of menstruation, increasing milk flow, toothache, nasal congestion, conjuctivitis, abscesses, and parasites.[4]

Culinary Uses in Ethiopia:

Seeds to flavor bread, to spice capsicum pepper sauce, curry sauce, *wot*, and to flavor local beverages.[1]

Herb-Drug Interactions:

Anticoagulants and drugs that increase the risk of bleeding: The methanol-soluble portion of the seed oil inhibits platelet aggregation , which may increase the risk of bleeding if used

along with drugs which also increase the risk of bleeding.[5]

Antihypertensives: The volatile oil from the seeds may lower blood pressure. Concurrent use with antihypertensives may be additive.[5]

Cisplatin: Extract of the plant is protective against cisplatin-induced decrease in hemoglobin and leucocytes.[5]

CNS depressants: Since administration of methanol or aqueous extract of the seed may result in CNS depression, additive effect may be observed when used concomitantly with CNS depressant dugs.[5]

Doxorubicin: The volatile oil constituent of black seed thymoquinone may suppress drug-induced nephrosis.[5]

Gentamicin: Black seed oil decreases gentamicin-induced nephrotoxicity.[5]

Insulin/Oral hypoglycemic agents: Black seed extract enhances pancreatic insulin secretion.[5]

Clinical Management:

Patients on insulin and oral hypoglycemic agents, and who take black seed at the same should be monitored for blood glucose levels.[5] The other interactions should also be closely monitored.

References:

1. Fullas F. Spice Plants in Ethiopia: Their Culinary and Medicinal Applications. Sioux City, IA, USA; 2003, pp 110-113.
2. Wilson RT, Gebre Mariam W. Medicine and Magic in Central Tigre: A Contribution to the Ethnobotany of the Ethiopian Central Plateau. *Econ Bot.* 1979; 33 (1): 29-34.
3. DerMarderosian A, Beutler JA, eds. Nigella Sativa. *The Review of Natural Products*. St. Louis, MO: Wolters Kluwer Health, Inc., Mar 2000.
4. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database*. 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 145-156.
5. Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY: Church Street Books, 2005, pp 51-53.

Capsicum peppers

Local (vernacular) names: Berbere, schriba, mitmita, qaria (A); afrindischi (Agew); filfil-ghedut (S); ademeda (Gambella)

Scientific name: *Capsicum annum* L., *C. frutescens* L., and hybrids of other *Capsicum* species

Family: Solanaceae

Common names: African chilies, capsicum, cayenne pepper, green pepper, goat's pod, grains of paradise, paprika, red pepper, tabasco pepper

Medicinal Uses:

In Ethiopia: Seeds (with lemon water) for *gormit*, *ye qola qusil*, and *chewe* (perhaps all topical ulcers);[1] other uses: for rabies and stomach pain[2]

Outside of Ethiopia: Orally as a digestant, antiflatulent, GI stimulant, for colic, diarrhea, cramps, toothache, insufficient peripheral circulation, for reducing blood cholesterol and for clotting tendencies, seasickness, alcoholism, malarial fever, yellow fever, other fevers, prevention of atherosclerosis and heart disease; topically, for pain from shingles, post-herpetic surgical neuralgias, and HIV-associated peripheral neuropathy, Also, as a counterirritant to desensitize nerves and to create a feeling of warmth, for relief of muscle spasms, against laryngitis (as a gargle), and as a deterrent for thumb-sucking or nail biting.[3]

Culinary Uses in Ethiopia:

A "national" spice in a variety of foods.[2]

Herb-Drug Interactions:

Acetaminophen: In rat models, capsaicin (the main constituent of capsicum) has been shown to increase the oral

absorption of acetaminophen.[4]

Anticoagulants and drugs that increase the risk of bleeding: Capsaicin may inhibit platelet aggregation, which may increase the risk of bleeding.[5]

Antihypertensive drugs: Capsaicin increases the production of catecholamines in the body, which may in turn counteract the effect of antihypertensives. The herb may also increase the adverse effects of MAOI drugs.[5]

Aspirin: Capsaicin reduces the bioavailability of salicylic acid (a metabolite of aspirin). It is gastroprotective against aspirin-induced injury. This may also apply to other NSAIDs, if the herb or capsaicin is given prior to the NSAID administration. However, capsaicin may increase the risk of bleeding.[5] In a study conducted in humans, it was observed that an intake of 20 gm of powdered chili half hour before aspirin administration reduced gastric mucosal damage in 18 subjects.[4]

Captopril: In a double-blind randomized investigation in16 healthy volunteers, pre-treatment with 25 mg of captopril intensified the cough induced by capsaicin inhalation when compared to pre-treatment with placebo. A 53-year old female patient who had been maintained on an angiotensin converting enzyme inhibitor (ACEI) [not specified] for several years complained of cough following topical application of 0.075% capsaicin cream to her lower extremities. The patient had not experienced cough while receiving the ACE inhibitor. It was not determined, however, whether the patient could have experienced the cough with the application of capsaicin cream alone.[6]

Cytochrome P450 Enzymes (CYP1A1/2, CYP2A2, CYP3A1, CYP2C11, CYP2B1, CYP2B2, CYP2C6): Cayenne inhibits these metabolizing enzymes, and thereby increases serum levels of drugs that are substrates of the enzymes.[5]

CNS depressants (hexobarbital, pentobarbital): Cayenne may enhance the effect of CNS depressant drugs.[5] Acute use of capsicum increases hexobarbital sleeping time, while chronic use has the opposite effect. The hypnotic effect of pentobarbital was enhanced by capsaicin, which inhibits the metabolism of the former.[4]

Ethylmorphine: In vitro, capsaicin inhibits the metabolism of ethylmorphine by hepatic microsomes.[4]

Insulin/Oral hypoglycemic agents: Capsaicin has hypoglycemic effect. Consumption of 5 g of chilli peppers decreases serum glucose levels, and increases the release of insulin.[5]

Theophylline: In rabbits, theophylline absorption was enhanced and its metabolism diminished, when capsaicin was administered prior to, or concurrently with theophylline.[4]

Clinical Management:

Patients should be advised to discontinue capsaicin use if they experience cough. Since the incidence of this effect is not yet known, and it is not presently possible to predict which patients will experience this adverse effect, complete avoidance of this combination may not be recommended. However, patients taking an ACEI drug should be advised that cough can be induced by capsaicin.[6] Signs and symptoms of excessive bleeding should be monitored closely if capsaicin and anticoagulants, antiplatelet agents, thrombolytic agents, or low molecular weight heparins are used concurrently. It is advisable to avoid consumption of large amounts of capsicum prior to receiving any of these agents. Until the clinical significance of the interaction in humans is determined, patients who are prescribed barbiturates should avoid concomitant use of capsaicin. Patients who are on theophylline and consume capsaicin should be monitored for theophylline levels and toxicity.[7]

References:

1. Tadesse M. Some medicinal plants of Central Shewa and South Western Ethiopia. *SINET: Ethiop J Sci* .1986; 9: 143-167.
2. Fullas F. Spice Plants in Ethiopia: Their Culinary and Medicinal Applications. Sioux City, IA, USA; 2003, pp 59-63.
3. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database.* 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 223-225.
4. Brinker F. Herb Contraindications and Drug Interactions. Third Edition. Sandy, OR: Eclectic Medical publications, 2001, p 58-59.
5. Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY:

Church Street Books, 2005.

6. Tatro DS, ed. Drug interaction Facts. St Louis, MO: Facts and Comparisons (A Wolters Kluwer Co); 2001, p 46.
7. Klasco RK (Ed.). DRUG-REAX® System. Thomson Micromedex. Greenwood Village, CO: Thomson Healthcare, Inc. (2006 Edition).

Castor

Local (vernacular) names: Gulo, qucima, chaqma, golqwa (A); ati (Gam);balambi, balan, balon, mbalcha (Saho); guli (Saho, T); hambalta, qobboo (O); coho, kobo, tofoile (S), qobo (G).

Scientific name: *Ricinus communis* L.

Family: Euphorbiaceae

Common names: African coffee tree, biofareira, castor bean, Mexico weed, Palma Christi, Tagantangan oil plant, wonder tree

Medicinal Uses:

In Ethiopia: Latex, for hemorrhoids and *neqersa*;[1] seed, as a laxative, for mental illnesses, rheumatism, and for wound dressing.[2]

Outside of Ethiopia: Oil, as a laxative; topically as an emollient, to dissolve cysts, growths, and warts, to soften bunions and corns, and to soothe the conjuctiva of the eyes after foreign bodies are removed from the eyes. Seed, as a cathartic, emetic, for leprosy, syphilis; topically, as a poultice of powdered seeds for skin inflammation, boils, carbuncles, abscesses, inflammation of the middle ear, and migraines.[3]

Herb-Drug Interactions:

Anthelminthic drugs: By serving as a vehicle, castor oil may increase the toxicity of oil-soluble anthelminthic drugs.[4]

Corticosteroids/laxatives/potassium wasting diuretics: When used with corticosteroids and potassium wasting diuretics, castor oil may increase the risk of potassium depletion. Concomitant use with other laxatives may lead to electrolyte and fluid depletion. Overuse of castor oil as a laxative may precipitate electrolyte imbalance, including hypokalemia.[3]

Digoxin: Castor oil may increase the risk of adverse effects of cardiac glycoside drugs, such as digoxin, etc.[3]

Droperidol: Concomitant use of castor oil and the anti-nauseant droperidol may lead to cardiac toxicity (QT prolongation, torsade de pointes, and cardiac arrest).[5]

Levomethadyl: Concurrent use of castor oil and the opioid analgesic levomethadyl may also result in QT prolongation.[6]

Oral drugs: Because of its capacity to decrease transit time (fast passage) in the gastrointestinal tract, castor oil may reduce the absorption of oral drugs.[3]

Clinical Management:

In patients who have taken castor oil, droperidol should be administered with extreme caution, as the risk of prolonged QT syndrome is increased, due to hypokalemia. This also holds true for other laxatives with the potential to deplete electrolytes, when administered with droperidol.[3]

References:

1. Tadesse M, Demissew S. Medicinal Ethiopian Plants: Inventory, Identification, and Classification. In: Plants Used in African Traditional Medicine as Practiced in Ethiopia and Uganda, Botany 2000: *NAPRECA Monograph Series No. 5*. Edwards S, Zemede A (eds). Addis Ababa, Ethiopia: NAPRECA, Addis Ababa University; 1992, pp 1-19.
2. Jansen PCM. Spices, Condiments and Medicinal Plants in Ethiopia, their Taxonomy and Agricultural Significance. Wageningan:PUDOC;1981; p 277.
3. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database*. 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 237-238
4. Brinker F. Herb Contraindications and Drug Interactions. Third Edition. Sandy, OR: Eclectic Medical publications, 2001, pp 55-56.
5. Product Info: Droperidol. Hospira, Inc., Lake Forest, Illinois, 10/2004.
6. Product Info: Orlaam®, levomethadyl. Roxane Laboratories, Inc, Columbus, Ohio, 5/2001.

Cinnamon

Local (vernacular) names: Qarafa (A); carafu (O), crefte (T)

Scientific name: *Cinnamomum zeylanicum* Garc. ex Bl.

Family: Lauraceae

Common names: Batavia cassia, Batavia cinnamon, Ceylon cinnamon, cinnamon, Padang-cassia, Panang-cinnamon, Saigon cassia, Saigon cinnamon

Medicinal Uses:

In Ethiopia: For cold symptoms[1]

Outside of Ethiopia: Bark, orally as an antispasmodic, antiflatulent, appetite stimulant, antidiarrheal, antimicrobial, anthelminthic, for common cold and influenza; topically, as a component of a multi-ingredient preparation for treating premature ejaculation. Flowers, as a blood purifier.[2]

Culinary Uses in Ethiopia:

To flavor tea, as an ingredient in red pepper spice mix, red pepper paste, and to spice various foods.[1]

Herb-Drug Interactions:

Antacids/sucralfate/H_2-antagonists/proton pump inhibitors: It is claimed that cinnamon increases stomach acid, thus interfering with antacids, sucralfate, H_2-antagonists, or proton pump inhibitors.[2]

Tetracycline: Cinnamon has been reported to interfere with tetracycline dissolution rates in a laboratory experiment. Therefore, simultaneous administration of cinnamon and tetracycline may slow tetracycline absorption.[3,4] The probable mechanism of the interaction is by the adsorption of tetracycline onto cinnamon bark powder.[4]

Clinical Management:

No specific recommendation has been reported. However, it may be prudent to avoid concomitant use of cinnamon and medications which decrease stomach acid. Simultaneous intake of cinnamon and tetracycline should also be avoided.

References:

1. Fullas F. Spice Plants in Ethiopia: Their Culinary and Medicinal Applications. Sioux City, IA, USA; 2003, pp 64-68.
2. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database*. 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 286-287.
3. DerMarderosian A, Beutler JA, eds. Cinnamon. *The Review of Natural Products*. St. Louis, MO: Wolters Kluwer Health, Inc., October 2005
4. Klasco RK (Ed.). DRUG-REAX® System. Thomson Micromedex. Greenwood Village, CO: Thomson Healthcare, Inc. (2006 Edition).

Clove

Local (vernacular) names: Qirinfud (A)

Scientific name: *Syzygium aromaticum* L. syn. *Caryophyllus aromaticus*, *Eugenia caryophyllata*, *E. aromatica*

Family: Myrtaceae

Common names: Caryophyllus, clous de girolfe, clove, flores caryophyllum, gerwurznelken nagelein

Medicinal Uses:

In Ethiopia: Externally, for unspecified eye disease; mixed with aloes for eye complaints and as a hair growth stimulant.[1]

Outside of Ethiopia: Flower bud, leaf, and stem, topically for toothache, as a counterirritant and for mouth and throat inflammation; as a component of multi-ingredient preparation for treating premature ejaculation, for flatulence, nausea, vomiting, and as an expectorant. Oil, orally as an antiemetic, antiflatulent, as an anesthetic, for tooth post-extraction alveoli (dry socket), mouth and throat inflammation, as a counterirritant and component in dental cements and fillings.[2]

Culinary Uses in Ethiopia:

As an ingredient in red pepper blend, red pepper paste (*awaze*), spiced hot powdered peas (*mitn shiro*), hot pepper mix (*mitmita*), spiced barley meal (*chiko*), to spice coffee, chicken bread and fried beef stew (*tibs wot*).[1]

Herb-Drug Interactions:

Anticoagulants/antiplatelet drugs/thrombolytic agents/low molecular weight heparins: Clove oil can potentiate the effects of anticoagulants and antiplatelet drugs,[2] thrombolytic agents and low molecular weight heparins.[3] In all cases, concurrent use of these agents with clove may increase the risk of bleeding. Eugenol and acetyl eugenol in clove oil inhibit platelet aggregation. In one study, clove oil inhibited human platelet aggregation induced by arachidonic

acid, collagen and platelet activating factor in a dose dependent manner, but did not affect aggregation induced by adenosine diphosphate (ADP). Clove oil reduced mortality in rabbits injected with arachidonic acid, or platelet activating factor. It fared better than aspirin in its antiplatelet effect, with an IC_{50} potency 20-40 times greater than that of aspirin. Injection of arachidonic acid or platelet activating factor causes sudden death in rabbits due to occlusive aggregates in the lung microvasculature. Pretreatment with aspirin or clove oil reduced the incidence of death induced by arachidonic acid.[3]

Antipyrine: Metabolism of aminopyrine by monooxygenase activity of hepatic microsomes is inhibited by clove, thus increasing the plasma level of antipyrine.[4]

Clinical Management:

No specific clinical management has been reported. There is no oral medicinal use of clove reported in Ethiopia, but it is commonly used as a spice. Therefore, it is advisable to avoid concomitant use of clove and drugs that have the potential to cause bleeding.

References:

1. Fullas F. Spice Plants in Ethiopia: Their Culinary and Medicinal Applications. Sioux City, IA, USA; 2003, pp 138-141.
2. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database*. 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 292-295.
3. Klasco RK (Ed.). DRUG-REAX® System. Thomson Micromedex. Greenwood Village, CO: Thomson Healthcare, Inc. (2006 Edition).
4. Brinker F. Herb Contraindications and Drug Interactions. Third Edition. Sandy, OR: Eclectic Medical publications, 2001, p 67.

Coriander

Local (vernacular) names: Dimbelal (A); debao, shucar (O); tsagha, zagada (T)

Scientific name: *Coriandrum sativum* L.

Family: Apiaceae or Umbelliferae

Common names: Chinese parsley, cilantro, coriandri fructus, coriander; korianader

Medicinal Uses:

In Ethiopia: Leaves and fruits for stomachache;[1,2] leaves, for colic and stomachache.[3]

Outside of Ethiopia: Orally, for dyspepsia, loss of appetite, as a stomach function stimulant, spasmolytic, antiflatulent, bactericide, fungicide, for diarrhea, worms, rheumatism and joint pain.[4]

Culinary Uses in Ethiopia:

Fruits as an ingredient of pepper powder, bread, and various dishes.[1]

Herb-Drug Interactions:

CNS Depressants: Coriander has anxiolytic property, relaxes muscles, and induces sedation.[5]

Insulin/Oral hypoglycemic agents: Concurrent use of coriander with insulin or hypoglycemic agents may lead to unintended hypoglycemia.[5]

Clinical Management:

Patients on insulin or hypoglycemic agents should be monitored for blood glucose levels.[5]

References:

1. Fullas F. Spice Plants in Ethiopia: Their Culinary and Medicinal Applications. Sioux City, IA, USA; 2003, pp 81-84.
2. Kloos H., Tekle A., W Yohannes L, et al. Preliminary studies of traditional medicinal plants in nineteen markets in Ethiopia: Use patterns and public health aspects. *Ethiop Med J* 1978; 16: 33-43.
3. Jansen PCM. Spices, Condiments and Medicinal Plants in Ethiopia, their Taxonomy and Agricultural Significance. Wageningan:PUDOC;1981; p 65.
4. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database*. 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 327-328.
5. Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY: Church Street Books, 2005, p 97.

Cumin

Local (vernacular) names: Ensilal, kamun (A); kamun, kamuna, kamun-bahari, hawaja (O); kemano (T)

Scientific name: *Cuminum cyminum* L. syn. *C. odorum* Salis

Family: Apiaceae or Umbelliferae

Common names: Cumi, cummin, cumin, faux anis, faux aneth, Krezkümmel, Rőmischer Kümmel

Medicinal Uses:

In Ethiopia: Topically, for skin problems.[1]

Outside of Ethiopia: Orally as an antiflatulent, stimulant, diuretic, aphrodisiac, for stimulating menstrual flow, and for diarrhea.[2]

Culinary Uses in Ethiopia:

To flavor *wot*, and in the preparation of decorated pan bread (*ambasha*).[1]

Herb-Drug Interactions:

Antidiabetic drugs: It is claimed that cumin has hypoglycemic properties, and therefore may interfere with diabetes therapy.[2]

Anticoagulants and drugs that increase the risk of bleeding: Cumin may increase the risk of bleeding when used with such drugs.[3]

Barbiturates: Theoretically, it might also increase or decrease the activity of barbiturates.[2]

Clinical Management:

Patients on insulin and hypoglycemic agents should be monitored for blood glucose levels.[3] Although no oral medicinal use of cumin has been reported in Ethiopia, its use as a spice

concomitantly with antidiabetic drugs may precipitate hypoglycemia. Furthermore, the concurrent use of cumin with anticoagulants and barbiturates should be monitored.

References:

1. Fullas F. Spice Plants in Ethiopia: Their Culinary and Medicinal Applications. Sioux City, IA, USA; 2003, pp 85-87.
2. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database*. 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 350-351.
3. Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY: Church Street Books, 2005, p 100.

Eucalyptus

Local (vernacular) names: Bahr zaf (A); neche barzaf (G); accachilt, aka chitta, akakilti, atakili, baarzaafii adi (O); botta zafiya (Wel); qelamitos (T)

Scientific name: *Eucalyptus globulus* Labill. and other Eucalyptus species

Family: Myrtaceae

Common names: Blue gum, eucalypti folium, eucalyptusblatter, fever tree, gum tree, stringy bark tree, southern blue gum, Tasmanian blue gum, white eucalyptus

Medicinal Uses:

In Ethiopia: Vapor from the leaves, for common cold;[1-3] leaf extract gargled for meningitis; other use, as an insect repellant.[1]

Outside of Ethiopia: Leaf, orally as an antiseptic, antipyretic, expectorant, stimulant in respiratory ailments, for respiratory tract mucous membrane inflammation, asthma, acne, bleeding gums, liver and gallbladder diseases, diabetes, fever, flu, gonorrhea, loss of appetite, neuralgia, ulcers, rheumatism, stomatitis, whooping cough, wounds, burns, and cancer. Oil, orally for inflammation of the respiratory tract mucous membranes, coughs, as an expectorant, cough drops, gum lozenges; topically, for inflammation of respiratory tract mucous membranes, rheumatic complaints, nasal stuffiness, as a mouthwash, antiseptic liniment, ointment, and in toothpaste, antipyretic, against wounds, burns, ulcers, cancer, in dentistry as a component of sealers and solvent for root canal and fillings.[4]

Herb-Drug Interactions:

Antidiabetic agents: Eucalyptus has shown hypoglyemic activity in rabbits and mice, and therefore might interact with anti-diabetic drugs. Concurrent use of eucalyptus and anti-diabetic agents

may result in increased risk of hypoglycemia. This was confirmed by an experiment carried out in mice. Hypoglycemia was induced in mice by administration of streptozocin. Mice that were pre- and post-treated with eucalyptus extract showed a marked decrease in their blood glucose levels compared to the group that were rendered diabetic, but were not treated with eucalyptus. Eucalyptus extract has been shown to enhance 2-deoxy-glucose transport by 50%, improve glucose oxidation by 60%, and enhance incorporation of glucose into glycogen by 90%.[5]

Aminopyrine: Aerosol inhalation of eucalyptol oil 10 minutes daily for 10 days increases the rate of metabolism and clearance of certain drugs, including aminopyrine in humans.[6]

Amphetamine/pentobarbital/zoxazolamine: Eucalyptus oil induces liver enzymes, which can reduce the activity of drugs metabolized by the liver.[4] Consumption of the leaves or inhalation of eucalyptol induces microsomal mixed-function oxidase enzyme systems in rats. In a rat experiment, aerosolized eucalyptus oil exposure for 2 to 10 minutes daily for 4 days followed 24 hours later by administration of amphetamine, pentobarbital, and zoxazolamine, decreased the length of time these drugs were effective.[6]

Other drugs: Eucalyptus weakens or shortens the effects of drugs due to alteration of drug metabolizing enzymes. The constituent 1,8-cineole may induce CYP2B1, thus reducing the serum levels of drugs that are metabolized by this isozyme.[7]

Clinical Management:

Patients who are on insulin and hypogylcemic medications should be monitored for blood glucose levels.[7] The other drugs listed above that can potentially interact with eucalyptus should also be monitored.

References:

1. Getahun A. Some Common Medicinal and Poisonous Plants Used in Ethiopian Folk Medicine. Addis Ababa, Ethiopia: Addis Ababa University; Mar 1976; 44 pp (mimeographed).
2. Fullas F. Ethiopian Traditional Medicine: Common Medicinal Plants in

Perspective, Sioux City, IA, USA; 2001, p 43.

3. MacLachlan M., Eshetie G., Fentahun T. (May, 2002). Manual of Highland Ethiopian Trees and Shrubs, Revised and Expanded. SIM Forestry Study Project, Banawee Printing Press, Ethiopia, p 397.
4. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database*. 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 407-409.
5. Klasco RK (Ed.). DRUG-REAX® System. Thomson Micromedex. Greenwood Village, CO: Thomson Healthcare, Inc. (2006 Edition).
6. Brinker F. Herb Contraindications and Drug Interactions. Third Edition. Sandy, OR: Eclectic Medical publications, 2001, p 91.
7. Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY: Church Street Books, 2005, p 116.

Fennel

Local (vernacular) names: Ensilal, kamun (A); kamuni, kamona (O); enselal, silan (T)

Scientific name: *Foeniculum vulgare* Mill syn. *Anethum graveolens* L., *F. officinale* All.

Family: Apiaceae or Umbelliferae

Common names: Carosella, common, sweet or bitter fennel, Florence fennel, finnochio, garden fennel, large fennel, and wild fennel

Medicinal Uses:

In Ethiopia: Leaf, for cough, diuresis, dysentery, headache, and stomachache;[1,2] root, for gonorrhea;[1] whole plant, for urinary incontinence (*shint mat*)[3]

Outside of Ethiopia: Fruit and seed, orally to enhance lactation, promote menstruation, facilitate birth, against indigestion, upper respiratory tract mucous membrane inflammation, cough, bronchitis, to stimulate appetite, against visual problems, and colic in infants. Oil, for mild spastic disorders of the GI tract, feeling of fullness, flatulence, respiratory mucous membrane inflammation, cough, bronchitis, for improving appetite, for digestion and other stomach problems.[4]

Culinary Uses in Ethiopia:

Fruits to spice *wot*; fruits, young stems and leaves to flavor the alcoholic beverages *arake*, *katikala* and *tedj*.[1]

Herb-Drug Interactions:

ACE Inhibitors: Chewing fennel fruits regularly is associated with the cessation of enalapril-induced coughing.[5]

Antihypertensives: Although fennel extract is known to lower arterial blood pressure, it is not known if this effect is additive

when combined with antihypertensive agents.[5]

Ciprofloxacin and other quinolones: Concomitant intake of ciprofloxacin and fennel reduces the bioavailability of the drug by as much as 50%, possibly due to chelating metal cations in fennel. There is also evidence suggesting that fennel increases tissue distribution and slows elimination of ciprofloxacin.[4] Co-administration of fennel aqueous extract at 2 gm/kg and ciprofloxacin at 20 mg/kg in mice reduced the maximum concentration (C_{max}) of ciprofloxacin 83%, while T_{max} (time to reach C_{max}) was virtually unaffected. Area under the curve (AUC) was reduced 48%. Fennel is known to contain metal cations such as calcium, manganese, iron, zinc, chromium, copper, nickel, and lead. A plausible explanation for the observed effects is the formation of ciprofloxacin-cation complex which is poorly absorbed. The same effect can be predicted for other quinolones such as cinoxacin, rosoxacin, norfloxacin, enoxacin, ofloxacin, lomefloxacin, temafloxacin, flenoxacin, sparfloxacin, levofloxacin, grepafloxacin, trovafloxacin, and moxifloxacin.[6]

Diuretics: Fennel has diuretic action. However, it is not known if this effect is additive with diuretic drugs.[5]

Clinical Management:

Administer ciprofloxacin and other quinolones 2 hours before, or 4 to 6 hours after fennel.[6]

References:

1. Fullas F. Spice Plants in Ethiopia: Their Culinary and Medicinal Applications. Sioux City, IA, USA; 2003, pp 92-95.
2. Kloos H., Tekle A., W Yohannes L, et al. Preliminary studies of traditional medicinal plants in nineteen markets in Ethiopia: Use patterns and public health aspects. *Ethiop Med J* 1978; 16: 33-43.
3. Abate G. (Demissew S, ed.). Este Debdabe (Ethiopian Traditional Medicine). Addis Ababa, Ethiopia: Biology Department, Science Faculty, Addis Ababa University; 1989, p 180.
4. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database*. 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 424-426.
5. Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY: Church Street Books, 2005, p 118.

6. Klasco RK (Ed.). DRUG-REAX® System. Thomson Micromedex. Greenwood Village, CO: Thomson Healthcare, Inc. (2006 Edition).

Fenugreek

Local (vernacular) names: Abish (A); hulbata (O)

Scientific name: *Trigonella foenum-graecum* L.

Family: Fabaceae or Leguminosae

Common names: Bird's foot, fenugreek, foenugreek , cow's horn, goat's horn, Greek hay, Greek hay seed, trigonella

Medicinal Uses:

In Ethiopia: As a carminative, tonic for gastric troubles, for rheumatism,[1] leprosy, and for wound dressing[2]

Outside of Ethiopia: Orally, for loss of appetite, hypertension in diabetics, constipation, atherosclerosis, high serum cholesterol and triglycerides, for promotion of lactation; topically as a poultice for local inflammation, myalgia, lymphadenitis, gout, wounds, leg ulcers, and eczema. Other uses: for kidney complaints, beriberi, hernia, impotence and other male problems.[3]

Culinary Uses in Ethiopia:

As a spice ingredient in bread, *wot*, bread, various sauces and stews, to flavor flour preparations made from barley and peas.[1]

Herb-Drug Interactions:

Antidiabetic drugs: Fenugreek alone and combined with glibenclamide (glyburide) reduced blood glucose in diabetic patients. Concomitant use of fenugreek and anti-diabetic agents may result in further reductions of blood glucose over that with anti-diabatic agents alone. Ten non-insulin dependent diabetic patients were divided into control and treatment groups. All patients were taking glibenclamide. Fenugreek was administered to the treatment group in 12.5 gm dose daily for 15 days. It was observed that in the treatment group the area under the curve (AUC) and half-life of plasma glucose was more significantly reduced than the control group.[4]

Lipid-lowering drugs: Fenugreek decreases total cholesterol and LDLs. It is not known if this effect may be additive with lipid lowering drugs.[5]

Oral drugs: The high mucilage content of fenugreek may reduce the intestinal absorption of drugs.[5]

Thyroid replacement therapy: Fenugreek alters T_3 and T_4 levels.[5]

Warfarin: A case report indicated that a 67-year-old woman on an oral dose of warfarin 2 mg daily experienced an increased anticoagulation after ingesting a fenugreek-containing product. Upon discontinuation of taking the product, she was less anti-coagulated and warfarin was back in the therapeutic range. However, the patient wanted to continue taking the product. The dose of warfarin had to be decreased by 15% to achieve the required anticoagulation.[6]

Clinical Management:

Patients on insulin and oral hypoglycemic agents should be monitored for blood glucose levels.[5] Because warfarin has a narrow therapeutic index, concurrent use with fenugreek should be avoided.[7] It has also been suggested not to take such oral medications within 2 hours of consuming fenugreek. The high fiber content of crushed fenugreek seeds may adsorb orally administered drugs.[8]

References:

1. Fullas F. Spice Plants in Ethiopia: Their Culinary and Medicinal Applications. Sioux City, IA, USA; 2003, p 154-157.
2. Jansen PCM. Spices, Condiments and Medicinal Plants in Ethiopia, their Taxonomy and Agricultural Significance. Wageningan:PUDOC;1981; p 280.
3. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database*. 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 427-428.
4. Klasco RK (Ed.). DRUG-REAX® System. Thomson Micromedex. Greenwood Village, CO: Thomson Healthcare, Inc. (2006 Edition).
5. Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY: Church Street Books, 2005, p 119.
6. DerMarderosian A, Beutler JA, eds. Fenugreek. *The Review of Natural Products*. St. Louis, MO: Wolters Kluwer Health, Inc., June 2005.

7. DerMarderosian A, Beutler JA, eds. Evidence-Based Herb-Drug Interactions. *The Review of Natural Products*. St. Louis, MO: Wolters Kluwer Health, Inc., July 2004.
8. Philp RB. Herbal-Drug Interactions and Adverse Effects. New York, NY: McGraw-Hill; 2004, p112.

Flax

Local (vernacular) names: Telba (A; G); talba (Had; Kef; Wel); muto (Kef); muuta (Me); kontar (O) lina (T); handhuudh, shimbireed (S)

Scientific name: *Linum usitatissimum* L

Family: Linaceae

Common names: Flax, flaxseed, linseed, lint bells, linum

Medicinal Uses:

In Ethiopia: As a purgative, diuretic, for diarrhea, and eye irritation;[1] seed, for gastric problems,[2] retained placenta,[3] for amoebic dysentery, itching, wound dressing, and as a laxative[4]

Outside of Ethiopia: For atherosclerosis and for cancer prevention; oil, against tumor, chronic renal disease, for delaying onset of diabetes, hypercholesterolemia, lupus nephritis, and mild menopausal symptoms,[5] as a topical demulcent, emollient, laxative, for coughs, colds, constipation, and urinary tract infections,[6] internally for chronic constipation, irritable colon, diverticulitis, gastritis, and enteritis (as mucilage), bladder catarrh and inflammation.[7]

Herb-Drug Interactions:

Anticoagulants: It also decreases platelet aggregation. Patients on anticoagulants taking flaxseed my run an increased risk of bleeding.[6]

Cardiac glycosides: Flaxseed can bind cardiac glycosides and other drugs to retard their absorption.[8]

Hormone replacement therapy: Flaxseed has been shown to alter the metabolism of endogenous hormone as well as increase serum prolactin in postmenopausal women. Effect on exogenous hormones and its clinical significance are not known.[5]

Insulin/Oral hypoglycemic agents: Flaxseed decreases

postprandial blood glucose levels.[5]

Laxatives: It has increased laxative effect when taken with other laxative drugs.[8]

Oral medications: Flaxseed contains mucilage, which impairs absorption of oral medications taken concomitantly.[6]

Clinical Management:

Patients who are on insulin and oral hypoglcemic agents should be monitored for blood glucose levels.[5] Flaxseed should be taken 2 hours before or after other oral medications.

References:

1. Belayneh H. Oil crop germplasm: a vital resource for the plant breeder. *In*: Engels JMM, Hawkes JG, Worede M, eds. Plant Genetic Resources of Ethiopia. New York: Cambridge University Press;1991; pp 344-353.
2. Tadesse M, Demissew S. Medicinal Ethiopian Plants: Inventory, Identification, and Classification. In: Plants Used in African Traditional Medicine as Practiced in Ethiopia and Uganda, Botany 2000: *NAPRECA Monograph Series No.5*.Edwards S, Zemede A (eds). Addis Ababa, Ethiopia: NAPRECA, Addis Ababa University; 1992, pp 1-19.
3. Giday M. Ethnobotanical study of medicinal plants used by the Zay people in Ethiopia. *CBM:s Skirftserie 3: Msc-theses*; 1999.
4. Jansen PCM. Spices, Condiments and Medicinal Plants in Ethiopia, their Taxonomy and Agricultural Significance. Wageningan:PUDOC;1981; p 72.
5. Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY: Church Street Books, 2005, p 121-122.
6. DerMarderosian A, Beutler JA, eds. Flax. *The Review of Natural Products*. St. Louis, MO: Wolters Kluwer Health, Inc., July 2004.
7. Gruenwald J, Brendler T, Jaenicke C. (Scientific Eds.). PDR for Herbal Medicines. 1st ed. Montvale, NJ: Medical Economics Company; 1998; pp 940-941.
8. Taylor JR. Phytomedicinals: Uses, precautions, and drug interactions. *Drug Top*. 2003; 147 (1): 79-88.

Garlic

Local (vernacular) name (s): Netch shinkurt (A); neche shinkurt (G); qullubbii adii (O); tsa'da shgurti (T)

Scientific name: *Allium sativum* L

Family: Liliaceae

Common name (s): Allium, camphor of the poor, garlic, man's treacle, nectar of the Gods, rustic treacle, stinking rose

Medicinal Uses:

In Ethiopia: For common cold, malaria, cough, lung TB, hypertension, wounds, sexually transmitted diseases, mental illnesses, kidney and liver diseases, asthma, parasitic infections, diarrhea, throat diseases, abdominal colic gastritis, eye diseases, toothache, diabetes, skin diseases, headache, typhus, swellings, back pain, hemorrhoids, as an antidote for snake bites.[1]

Outside of Ethiopia: Orally for high blood pressure, coronary heart disease, to improve lipid profile, prevent age-related vascular change and atherosclerosis, for reducing re-infarction and mortality in post-myocardial infraction, earache, menstrual disorders, *Heliobacter pylori* infection, cancer prevention, immune system stimulation, diabetes, arthritis, allergies, traveler's diarrhea, colds, flu, bacterial and fungal infections, enhancing circulation, stress, and fatigue. Topically, for *tinea pedis*, *tinea corporis*, and *tinea cruris*.[2]

Culinary Uses in Ethiopia:

As an ingredient in barley flour, beans flour, herbed butter, green pepper paste, red pepper paste, and spiced oil.[1]

Herb-Drug Interactions:

Acetaminophen: Fresh garlic at 5 mg/kg in mice prevented

hapatotoxicity from acetaminophen as demonstrated by enzymes and liver biopsy. Garlic and its S-allyl constituents inhibited cytochrome P450 sub-type 2E1 oxidation of acetaminophen and thereby reducing its toxicity. Aged garlic alcoholic extract on the other hand did not prevent hepatotoxicity.[3]

Antihypertensive drugs: Garlic has hypotensive activity. However, it is not clear if this effect is cumulative with antihypertensive drugs.[4]

Aspirin, clopidogrel, enoxaparin: There are reports which theoretically implicate garlic in enhancing adverse effects of aspirin, clopidogrel, enoxaparin and others.[2]

Cholesterol-lowering drugs: It may also enhance the effects of cholesterol-lowering drugs, since garlic has been shown in a clinical meta-analysis trials in humans to lower total cholesterol levels.[3] One year of aged garlic extract administration prevented the progression of coronary calcification in patients with coronary artery disease taking statins and aspirin.[4]

Doxorubicin: The S-allyl constituent of garlic decreases some of the adverse effects of the anti-cancer drug. Fresh garlic homogenate at 500 mg/kg and aged garlic extract reduce doxorubicin-induced cardiomyopathy.[4]

Drugs that are substrates of CYP1A2, CYP2D6, CYP3A4, and CYP2E1: Garlic oil has been shown to decrease CYP2E1 activity in both young and elderly patients, but had no significant effect on CYP1A2, CYP2D6 or CYP3A4 phenotypes. The S-allylmercaptocysteine component of garlic has been shown to reduce the activity of CYP2E1 in experimental mice. There are conflicting results for the interactions of garlic and CYP3A4 substrates.[4]

Gentamicin: Aged garlic decreases gentamicin-induced nephropathy.[4]

Indomethacin and dipyridamole: The garlic constituent ajoene potentiates the anti-aggregation activity of indomethacin and dipyridamole in a synergistic fashion. The anti-thrombotic activity of garlic aqueous extract may be due in part to the inhibition of thromboxane B_2 synthesis. Therefore, the effects of anti-coagulant medications may be enhanced.[3]

Insulin/Oral hypoglycemic agents: Theoretically, garlic may interfere with insulin dosing due to its hypoglycemic effect.[3] In one study of non-diabetic patients, blood glucose decreased in men but increased in women. Results of research have been equivocal.[4]

Isoprenaline: When tested in rats, garlic powder protects the heart, liver and pancreas from isoprenaline-induced damage in a dose dependent manner.[3]

Methotrexate: Aged garlic extract decreases methotrexate-induced damage of the small intestine.[4]

Omeprazole: Raw garlic and commercial garlic supplements are synergistic with omeprazole against *Heliobacter pylori.*[4]

Saquinavir: Following a 20-day course of garlic (equivalent to 8 gm of fresh garlic cloves daily), given with breakfast and dinner, and continuing thereafter, healthy subjects received 1200 mg of saquinavir three times daily with meals for 3 days. Thereafter, saquinavir and garlic were discontinued for 10 days., and a final 3-day course of saquinavir was administered, without garlic pre-treatment. When administered following garlic, the area under the concentration-time curve (AUC) and peak plasma concentration of saquinavir were decreased 51% and 54%, respectively. When sasquinavir was administered 10 days after the discontinuation of garlic, the mean AUC was still 35% below the pre-garlic values. Reduced saquinavir concentrations may result in decreased antiviral effect. However, shorter exposure to garlic or low doses is less likely to affect saquinavir levels[5]

Thyroid replacement therapy: Garlic extract reverse the effects of exogenous administration of thyroxine. High does of garlic decrease T_3 and T_4 levels[4]

Vinblastine and vincristine: The diallyl sulfide constituent of garlic decreases resistance to these anti-cancer drugs, and improves their cytotoxicity.[4]

Warfarin: Several anecdotal cases of episodes of bleeding have been reported in people taking garlic with or without warfarin therapy. Nonetheless, a causal relationship has not been established. The available data are not sufficient to warrant a warning for patients on warfarin to avoid garlic in foods and garlic supplements. There are

likely to be differences in the quantities and constituents in different processed garlic products.[5] In human case reports, it was observed that the intake of garlic doubled the International Normalized Ratio (INR) [a measure of the time it takes the blood to clot] in 2 patients who had been stabilized on warfarin. As shown by the fibrinolytic and diminished platelet aggregation activity in humans, the garlic constituents allicin, ajoene, vinyl dithins and trisulfaides are responsible for the observed effects. Garlic tablets at a dose of 400 mg twice daily for 12 weeks reduced spontaneous platelet aggregation by 59% compared to placebo in 80 patients.[3]

Clinical Management:

Patients on insulin and oral hypoglycemic agents should be monitored for blood glucose levels.[4] If garlic is to be used, the dose of the hypoglycemic agent should be adjusted accordingly.[2] Concomitant use of garlic and anticoagulants is not recommended. If garlic is taken along with an anticoagulant medication, bleeding time and signs and symptoms of excessive bleeding should be monitored. A baseline bleeding time should be obtained for patients on garlic therapy prior to initiating an anticoagulant. Ingestion of regular amounts of garlic in foods does not pose any problem. It is only when excessive amounts of garlic are taken that the INR or/and bleeding time need to be monitored.[6] Garlic intake should be discontinued at least seven days before surgery to avoid the risk of over-bleeding.[4] High doses of garlic should be avoided in patients who receive thyroid replacement therapy.[4] If garlic extract is taken concurrently with indomethacin, signs and symptoms of excessive bleeding should be monitored.[6] The concomitant use of garlic with protease inhibitors should be avoided. If the patient has been using garlic supplements while on a protease inhibitor, the blood levels and toxicity symptoms of the protease inhibitor should be assessed, and if necessary the dose should be adjusted.[6]

References:

1. Fullas F. Spice Plants in Ethiopia: Their Culinary and Medicinal Applications. Sioux City, IA, USA; 2003, pp 40-43.

2. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database*. 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 465-466.
3. Brinker F. Herb Contraindications and Drug Interactions. Third Edition. Sandy, OR: Eclectic Medical publications, 2001, pp 100-101.
4. Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY: Church Street Books, 2005, pp129-32.
5. Hanston PD, Horn JR. Drug Interactions Analysis and Management. St Louis, MO: Facts and Comparisons: 2001; pp 658-658a.
6. Klasco RK (Ed.). DRUG-REAX® System. Thomson Micromedex. Greenwood Village, CO: Thomson Healthcare, Inc. (2006 Edition).

Ginger

Local (vernacular) names: Zingibil (A; T); jinjibl (G)

Scientific name: *Zingiber officinale* Rosc.

Family: Zingiberaceae

Common names: Ginger

Medicinal Uses:

In Ethiopia: Rhizome, for stomachache,[1] infected uvula, cough, as a component in multi-ingredient formulas,[2] for fever and influenza[3]

Outside of Ethiopia: For motion sickness, colic dyspepsia, flatulence, rheumatoid arthritis, loss of appetite, anorexia, post-surgical nausea and vomiting, anorexia, upper respiratory tract infections, cough and bronchitis. Topically, for thermal burns.[4]

Culinary Uses in Ethiopia:

For spicing *wot*, to flavor tea, and in the preparation of alcoholic drinks.[2]

Herb-Drug Interactions:

Antacids: Antacids may be antagonized by ginger due to irritation of the gastric mucosa. However, water and methanol extracts of ginger both decreased gastric secretion of acid and pepsin, and extracts of ginger reduced ulcer formation induced by gastric irritants.[5]

Anticoagulants and drugs that increase the risk bleeding during surgery: Dose of 2 or 4 gm of ginger did not affect platelet aggregation, but 5 to 10 gm of powdered ginger decreased platelet aggregation. No bleeding was reported at 5 gm daily dose. It is not known if concurrent use of ginger with drugs may increase the chance of bleeding.[6] A clinical trial of dried ginger on platelet activity failed to show any difference in the bleeding times between treatment and placebo groups. However, large doses (12-14 gm) may

enhance hypothrombinemic effects of anticoagulants, but the clinical significance of this finding has not been evaluated.[7] Available data are conflicting. There are studies demonstrating inhibition of platelet aggregation in individuals ingesting ginger, which points to an increase in the risk of bleeding. On the other hand, there is also a study showing that short term (less than 24 hours) ingestion of 2 gm of ginger powder capsules had no effect on bleeding time, platelet count, or platelet aggregation.[8]

Antihypertensives: An additive effect of ginger is possible with antihypertensive drugs, especially with calcium channel blockers.[6]

Aspirin: Ginger is protective against aspirin-induced gastric ulcers.[6]

Atacuronium, thiopental, vercuronium: In human clinical trials, 1 gm of powdered ginger given prior to surgery reduced nausea in 20 female patients caused by anesthetics, thiopental, atcuronium, and vercuronium, when compared to 20 controls. Similar effect was observed in 40 outpatients compared to the same number of patients who received propofol, fentanyl, and atcuronium.[5]

Blood pressure therapy: Due to its hypotensive or hypertensive effects, ginger might interfere with blood pressure therapy. Because of its inotropic effects, it may also interfere with cardiac drug therapy.[5]

Chemotherapeutic agents/cyclophosphamide/cisplatin: Ginger may decrease nausea from chemotherapeutic drugs.[6] Vomiting, induced by the anti-cancer cyclophosphamide can be prevented by prior administration of an extract of ginger or its 6–gingerol constituent.[5] Ginger significantly reverses delay in gastric emptying caused by cisplatin.[6]

Indomethacin/NSAIDs: Ginger is protective against indomethacin and NSAIDS--induced ulcers.[6]

Insulin/ Oral hypoglycemic agents: Ginger lowers blood glucose levels. Concurrent use of ginger with insulin or hypoglycemic agents may have variable effects. Extract of ginger enhances insulin-sensitivity in adipocytes.[6]

Phenprocoumon: Ginger increases INR in patients treated with phenprocoumon.[6]

Sertraline/Other SSRIs: Case reports have appeared where ginger might be effective for treating dis-equilibrium and nausea resulting from discontinuation or tapering of sertraline and other selective serotonin re-uptake inhibitors (SSRIs).[4]

Sulfaguanidine: According to experiments in rats, ginger may enhance the absorption of sulfaguanidine.[7]

Clinical Management:

Caution is advised if ginger and an anticoagulant, a low molecular weight heparin, an anti-platelet agent, or a thrombolytic agent are taken concurrently. However, the clinical significance of any effect ginger may have on platelet aggregation is undetermined.[9] Reports of ginger-induced inhibition of platelet function have appeared, but others have failed to confirm this effect.[10] Studies suggest that over four grams of dried or 15 grams of raw ginger root must be ingested daily to have any effect on blood coagulation.[9]

References:

1. Wilson RT, Gebre Mariam W. Medicine and Magic in Central Tigre: A Contribution to the Ethnobotany of the Ethiopian Central Plateau. *Econ Bot* 1979; 33 (1): 29-34.
2. Fullas F. Spice Plants in Ethiopia: Their Culinary and Medicinal Applications. Sioux City, IA, USA; 2003, pp 158-162.
3. Jansen PCM. Spices, Condiments and Medicinal Plants in Ethiopia, their Taxonomy and Agricultural Significance. Wageningan:PUDOC;1981; p 128.
4. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database*. 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, p 746.
5. Brinker F. Herb Contraindications and Drug Interactions. Third Edition. Sandy, OR: Eclectic Medical publications, 2001, pp 102-103.
6. Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY: Church Street Books, 2005, p 134.
7. Blumenthal M. Interactions Between Herbs and Conventional Drugs: Introductory Considerations. *HerbalGram* 2000; 49:52-63.
8. DerMarderosian A, Beutler JA, eds. Ginger. *The Review of Natural Products*. St. Louis, MO: Wolters Kluwer Health, Inc., July 2004.

9. Klasco RK (Ed.). DRUG-REAX® System. Thomson Micromedex. Greenwood Village, CO: Thomson Healthcare, Inc. (2006 Edition).
10. Hanston PD, Horn JR. Drug Interactions Analysis and Management. St Louis, MO: Facts and Comparisons: 2001; p 662a.

Indian long pepper

Local (vernacular) names: Timiz (A)

Scientific name: *Piper longum* L.

Family: Piperaceae

Common names: Indian long pepper, long pepper

Medicinal Uses:

In Ethiopia: Although, *P. longum* is substituted for *P. nigrum* as a spice,[1] there is no reported medicinal use for this plant in Ethiopia.

Outside of Ethiopia: For headache, toothache, asthma, beriberi, bronchitis, mucous membrane inflammation, cholera, coma, cough, diarrhea, dysentery, epilepsy, fever, frigidity, stomachache, stroke, heartburn, indigestion, insomnia, leprosy, lethargy, enlarged spleen, muscle pain, nasal discharge, painful menses, paralysis, psoriasis, sterility in women, snake-bites, tetanus, thirst, tuberculosis, and tumor. Other uses; for stimulating menstrual blood flow, increasing appetite, bile flow, improving digestion, to induce sweating, as an abortifacient, analgesic, antiflatulent, aphrodisiac, astringent, bactericide, larvicide, sedative, stimulant, tonic and vermifuge.[2]

Culinary Uses in Ethiopia:

Inflorescence, to spice *wot*.[3]

Herb-Drug Interactions:

Aspirin: Water decoction of the herb is protective against aspirin-induced ulcers.[4]

Benzamphetamine and aminopyrine: When a dose of 100 mg/kg was given 1 hour prior, piperine (a major alkaloidal constituent of *P. longum*) diminished the metabolism of benzamphetamine and aminopyrine.[5]

Capsaicin: It has been demonstrated that cross-tachyphylaxis occurs with piperine and capsaicin.[5]

Cytochrome P450 Isozymes: *P. longum* suppresses the expression of CYP2E1, and enhances the expression of CYP2B and CYP1A. Therefore, the metabolism of drugs which are substrates of these enzymes may be altered. Piperine has also been shown to be a non-specific inhibitor of P450 enzymes.[4]

Ethylmorphine: In vitro test has shown that piperine is a non-specific inhibitor of ethylmorphine and 7-ethoxy coumarin via inhibition of mixed function oxidases and different cytochrome P-450 forms.[5]

Hexobrabital/Zoxazolamine: When dosed at 5 mg/kg as a pre-treatment in rats, hexobrabital sleeping time was prolonged, while at a dose of 2.5 mg/kg, zoxazolamine paralysis time increased.[5]

Indomethacin: Piperine is protective against indomethacin-induced ulcer.[4]

β-lactam antibiotics: Piperine enhances the bioavailabilty of β-lactam antibiotics.[4]

Phenytoin: When used concomitantly with phenytoin, long pepper speeds absorption of the latter, and slows its excretion, thus in effect increases the serum dilantin levels.[2] Concomitant intake of phenytoin and piperine (a constituent of *P. longum*) by 5 male humans resulted in a more rapid and complete absorption of phenytoin. Piperine has also been shown to increase intestinal cell permeability in vitro.[5]

Propranolol/theophylline: If administered with propranolol, it speeds absorption and increases serum concentrations of propranolol.[2] When 20 mg piperine was administered to 12 non-smokers daily for seven days along with propranolol or theophylline, both drugs reached significantly greater serum concentrations.[5]

Rifampicin/sulfadiazine/tetracycline/phenobarbital: In human studies, at 1 to 3 mg dose levels, piperine has also been shown to increase blood levels of rifampicin, sulfadiazine, tetracycline, and phenobarbital when used concurrently.[5]

Clinical Management:

Although no specific required intervention has been reported, it is prudent to monitor the effects of all medications listed above, when a patient in Ethiopia uses *Piper longum* in significant quantities as a spice.

References:

1. Goettsch E. Spice germ plasm in Ethiopia. *In*: Engels JMM, Hawkes JG, Worede M, eds. Plant Genetic Resources of Ethiopia. New York: Cambridge University Press;1991; pp 123-130.
2. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database*. 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 590-591.
3. Fullas F. Spice Plants in Ethiopia: Their Culinary and Medicinal Applications. Sioux City, IA, USA; 2003, pp 124-126.
4. Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY: Church Street Books, 2005, p 207.
5. Brinker F. Herb Contraindications and Drug Interactions. Third Edition. Sandy, OR: Eclectic Medical publications, 2001, pp 41-42.

Jimson Weed

Local (vernacular) names: Astenagir; etse faris (A)

Scientific name: *Datura stramonium* L.

Family: Solanaceae

Common names: Angel tulip, datura, devil's apple, devil's trumpet, Jamestown weed, locoweed, mad-apple, nightshade, Peru-apple, stinkweed, stinkwort, stramonium, thorn-apple

Medicinal Uses:

In Ethiopia: Leaf (ground) as a fungicide;[1] root for otitis, rectal prolapse, wet eczema,[2] and toothache;[3] sap from leaf for burns;[1] seed for asthma and chronic cough.[4]

Outside of Ethiopia: Orally, for asthma, spastic and convulsive cough, pertussis during bronchitis and influenza, diseases of the autonomic nervous system, induction of hallucination and euphoria.[5]

Herb-Drug Interactions:

Anticholinergic drugs: Concomitant use with anticholinergic drugs may increase anticholinergic effects and adverse effects. These drugs include amantadine, atropine, belladonna alkaloids, phenothiazines, scopolamine, and tricyclic antidepressants.[5]

Clinical Management:

No specific recommendation has been reported. As a matter of precaution, it is advisable to monitor all drugs in the above class.

References:

1. Wilson RT, Gebre Mariam W. Medicine and Magic in Central Tigre: A Contribution to the Ethnobotany of the Ethiopian Central Plateau. *Econ Bot* 1979; 33 (1): 29-34.

Khat

Local (vernacular) names: Chat, tchat (A); jimma, gofa, ciut (T; O)

Scientific name: *Catha edulis* Forssk.

Family: Celastraceae

Common names: Abyssinianti, African salad, Abyssinian tea, Arabian tea, Bushman's tea, catha, flower of paradise, Chirinda redwood, khat, Kusel-Salahin, quat, Somali tea, tohai

Medicinal Uses:

In Ethiopia: As an ingredient in multi-component traditional herbal formulas such as aphrodisiac,[1] for mental illness/exorcism,[2] otitis media,[3] stomach trouble,[4] venereal diseases,[5] sorcery poisoning,[6] and stomach complaints; bark, for gonorrhea; sap of leaves, for eye diseases; leaves, for common cold and headache[7]

Outside of Ethiopia: Leaves: for depression, fatigue hunger, obesity, gastric ulcers, and euphoria.[8]

Herb-Drug Interactions:

Amoxicillin and ampicillin: The gastrointestinal absorption of the antibiotics amoxicillin and ampicillin may be reduced by chat chewing or ingestion, possibly decreasing the effectiveness of the antibiotics. The effects of chat chewing on the bioavailability of amoxicillin and ampicillin were studied in eight healthy Yemeni volunteers. The per cent of dose of unchanged amoxicillin and ampicillin excreted in the urine and the peak excretion were reduced by chat chewing. In addition, the time to reach ampicillin peak concentration was delayed. However, taking amoxicillin and ampicillin two hours after chewing chat does not appear to affect the bioavailability of the antibiotics.[8] Of all the constituents of chat, tannins appear to be the likely compounds responsible for complexing with β-lactam nitrogen of amoxicillin and ampicillin,

thus rendering the antibiotics unabsorbable or poorly absorbed.[9] Other mechanisms proposed for the observed effect include the astringent action of tannins on the absorbing mucous membrane of the gut, or the presence of ascorbic acid in chat which may affect the absorption pattern of the antibiotics. Yet another explanation is an altered blood flow in the gut caused by chat to affect the absorption of the antibiotics.[10]

Amphetamines: Cathinone, a component of khat, has actions similar to amphetamines, and hence may have additive effect if used together.[11]

Bromocriptine: It reverses the effects of khat. It is therefore used to treat khat addiction.[11]

Furazolidone: The drug has MAOI activity. Khat may increase pressor sensitivity.[11]

Guanethidine: Khat may displace guanethidine from adrenergic neurons, thereby reducing the antihypertensive effect of guanethidine.[11]

Indoramin: It improves the problem of urine flow in males using khat.[11]

MAOIs: Due to the catecholamine releasing effect of khat, the sympathomimetic effect of MAOIs is increased.[11]

Thyroid replacement therapy: The khat constituents cathinone and *N*-formylnorepinephrine at higher doses increase serum T_4 and T_3 levels in rats. Simultaneous use may cause thyroid storm.[11]

Clinical Management:

Amoxicillin should be taken no sooner than two hours after chewing khat to prevent a decrease in bioavailability of the drug.[11]Since khat has interactions with a number of medications, including antihypertensive agents and stimulants, it is advisable to monitor these drugs in patients who regularly consume khat.

Special Notes:

Excellent reviews have been written regarding the general legal problems and health hazards associated with the use of khat. [12,13] The widespread use of khat in Ethiopia presents unique economic and

health challenges. Suffice it to mention that the problems khat causes far outweigh the purported medicinal uses attributed to it. A recent study in Ethiopia has shown that khat chewing has close association with the incidence of HIV infection, which is further compounded by the concurrent abuse of alcohol.[14] Also, the interactions that khat has with a number of conventional drugs may add to the many reasons why khat use should be discouraged.

References:

1. Abebe D, Ayehu A. Medicinal Plants and Enigmatic Health Practices of Northern Ethiopia. Addis Ababa: B.S.P.E; 1993; pp 50,57.
2. *Ibid.* p 77.
3. *Ibid.* p129.
4. *Ibid.* p168.
5. *Ibid.* p 215
6. *Ibid.* p 380.
7. Jansen PCM. Spices, Condiments and Medicinal Plants in Ethiopia, their Taxonomy and Agricultural Significance. Wageningan:PUDOC;1981; pp 167-168.
8. DerMarderosian A, Beutler JA, eds. Khat. *The Review of Natural Products*. St. Louis, MO: Wolters Kluwer Health, Inc., July 2004.
9. Attef OA, Ali A-A A, Ali HM. Effect of Khat chewing on the bioavailability of ampicillin and amoxicillin. *J Antimicrob Chemotherp* 1997; 39: 523-525.
10. Ghani YM, Etman MA, Nada AH. Effect of khat chewing on the absorption of orally administered amoxicillin. *Acta Pharm*. 1999; 49: 43-50
11. Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY: Church Street Books, 2005, pp 192-193.
12. Woldemichael WA. Understanding the Regulation of Khat. *Addis Tribune*; 5/9/03.
13. _____. Health Hazards Associated with Khat Consumption. *Addis Tribune*; 12/26/03.
14. Abebe D, Debella A, et al. Khat chewing habit as a possible risk behavior for HIV infection: A case-control study. *Ethiop J Health Dev* 2005: 19 (3): 174-181.

Lemon

Local (vernacular) names: Lomi, lomit (A)

Scientific name: *Citrus limon* L.

Family: Rutaceae

Common names: Lemon, limon

Medicinal Uses:

In Ethiopia: Leaf, for cough; juice, for eye problems, teeth cleaning, and tonsilitis in children, as an ingredient in traditional formulas for various ailments.[1]

Outside of Ethiopia: For scurvy,[2] colds, and as a source of vitamin C for general low resistance.[3]

Culinary Uses in Ethiopia:

In the preparation of dried fish, boiled beets, to spice chicken bread, and to flavor other foods.[1]

Herb-Drug Interactions:

Chloroquine: Lemon may reduce the plasma concentration of chloroquine, thus decreasing the therapeutic effect. The effects of freshly prepared beverage containing *Citrus limetta* (lemon) on the pharmacokinetics of chloroquine were studied in male Sudanese adults. Each subject received a single 600 mg oral dose of chloroquine with 300 ml of the lemon beverage, or water. Compared with water, the lemon beverage reduced the area under the curve (AUC) and plasma level of chloroquine 68% and 62%, respectively.[2]

Clinical Management:

Patients should avoid taking chloroquine with beverages prepared from lemon.[4]

References:

1. Fullas F. Spice Plants in Ethiopia: Their Culinary and Medicinal Applications. Sioux City, IA, USA; 2003, pp 69-73.
2. Gruenwald J, Brendler T, Jaenicke C. (Scientific Eds.). PDR for Herbal Medicines. 1st ed. Montvale, NJ: Medical Economics Company; 1998; p 756.
3. DerMarderosian A, Beutler JA, eds. Lemon. *The Review of Natural Products*. St. Louis, MO: Wolters Kluwer Health, Inc., July 2004.
4. DerMarderosian A, Beutler JA, eds. Evidence-based Herb-Drug Interactions. *The Review of Natural Products*. St. Louis, MO: Wolters Kluwer Health, Inc., July 2004.

Lemongrass

Local (vernacular) names: Tej sar (A);
chita, masarata, shek hussen (O)

Scientific name: *Cymbopogon citratus* (DC.) Stapf.

Family: Graminae

Common names: *Andropogon citratus*, Guatemala lemongrass, Madagascar lemongrass, capium-cidrado

Medicinal Uses:

In Ethiopia: Leaf, for common cold, "*buda beshita,*"small pox, stomachache,[1] chest, heart, and stomach complaints[2]

Outside of Ethiopia: For loss of appetite, atherosclerosis, depression, fever, cold, cough, bronchitis, hypertension, tendency toward infection, inflammation of the mouth and pharynx. Other uses: for whooping cough, asthma, angina, stimulation of gallbladder, dehydration, as a menstrual aid, for diabetes, snakebite wounds, light burns, furuncles, warts, bruises, as an antiflatulent, anthelminthic, and diuretic.[3]

Herb-Drug Interactions:

Drugs that are substrates for CYP2B: β-Myrcene (acrylic monoterepene constituent of the essential oil of lemon grass) may induce CYP2B isozyme, which may decrease the serum levels of many drugs metabolized by these enzymes.[4]

Clinical Management:

No specific intervention has been reported.

References:

1. Kloos H., Tekle A., W Yohannes L, et al. Preliminary studies of traditional medicinal plants in nineteen markets in Ethiopia: Use patterns and public health aspects. *Ethiop Med J* 1978; 16: 33-43.

2. Jansen PCM. Spices, Condiments and Medicinal Plants in Ethiopia, their Taxonomy and Agricultural Significance. Wageningan:PUDOC;1981; p 267.
3. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database.* 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 779-780.
4. Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY: Church Street Books, 2005, p 199.

Marijuana

Local (vernacular) names: Astenagr, Etse faris (A)

Scientific name: *Cannabis sativa* L.

Family: Cannabinaceae

Common names: Anashaca, bhang, cannabis, charas, esrar, ganja, grass, hash, hashish, mariguana, marihuana, pot, sawi, sinsemilla, weed

Medicinal Uses:

In Ethiopia: Mixed with other herbs and powder smoked, as intelligence booster;[1] leaves and fruits, for epilepsy,[2] and topically, for headache.[3]

Outside of Ethiopia: Orally, for euphoria; synthetic dronabinol for anorexia or loss of appetite associated with AIDS, nausea and vomiting from cancer chemotherapy, unresponsive to standard anti-nausea and vomiting medications. As inhalant, for nausea, reducing intraocular pressure, appetite stimulation, altering senses (phsychoactivity), euphoria, mucous membrane inflammation, leprosy, fever, dandruff, hemorrhoids, obesity, and anorexia secondary to weigh loss in AIDS patients.[4]

Herb-Drug Interactions:

Amphetamines, anticholinergics, antihistamines, cocaine, hypnotics, sedatives, and psychomimetics: Dronabinol, a synthetic version of δ-tetrahydrocannabinol (THC) found naturally in *C. sativa*, can have additive and synergistic effects with amphetamines, anticholinergics, antihistamines, cocaine, hypnotics, sedatives, and psychomimetics.[4]

Barbiturates: Marijuana can decrease barbiturate clearance rates.[4] Simultaneous intake of barbiturates and inhalation of marijuana results in additive affects with greater subjective intoxication and behavioral impairment as evidenced in human

studies.[5]

Cyclophophamide, doxorubicin, cisplatin, procarbazine, methotrexate, dacarbazine, and streptozocin: Vomiting induced by these chemotherapeutic agents that was not improved by standard anti-emetic agents was relieved by marijuana in 78% of patients.[5]

Fluoxetine and disulfuram: When taken with fluoxetine and disufuram, it may cause transient hypomanic episodes.[4]

Ritonavir: Concurrent use with the antiretroviral drug ritonavir may result in increase in dronabinol serum concentrations and potential toxicity.[6]

Theophylline: It increases theophylline metabolism.[4]

Clinical Management:

Patients on dronabinol, a synthetic version of the natural constituent THC in marijuana, should be monitored for signs and symptoms of antiemetic toxicity, such as sedation, diarrhea and constipation. In such cases, reduction of dronabinol dose may be required.[6] Patients should not operate heavy machinery or perform other tasks which require mental alertness if barbiturates are taken along with cannabis. Patients presenting with cocaine toxicity may have a history of concomitant use of cannabis. Caution is advised if patients take concurrently protease inhibitors. CD4+ cell counts, HIV RNA, and serum p24 antigen should be regularly monitored to determine the continued effectiveness of the protease inhibitors. Patients who smoke cannabis may require higher doses of theophylline. If taken with tricyclic antidepressants, heart rate should be monitored closely.[6]

Special Notes:

Dronabinol, the synthetic version of the natural THC constituent of marijuana, is available as a prescription drug. However, the medical use of marijuana itself has been a subject of much controversy in the West. Proponents of medical use of marijuana have advanced the argument that it is useful in certain conditions such as chemotherapy-induced nausea in cancer patients, to increase appetite and weight in AIDS patients, and possibly in

reducing ocular pressure in glaucoma patients.[7] Many people interested in taking marijuana for medicinal purposes claim that no other substance offers the same quality of relief from pain and other symptoms. On the other side of the controversy, opponents argue that users try to maneuver the legal system by advancing medical reasons to justify its use. Obviously, marijuana is a mind-altering addictive substance with multiple adverse effects.[8]

According to a survey published in 1999, the use of cannabis has been on the rise in Ethiopia. A retrospective analysis of police records (1993-1997) revealed that almost all of illicit drug-related crimes involved cannabis being used or handled by traffickers. Shashemeni, Quara, and Metema areas in northern Gondar, Harar, Garamuleta areas in the east were identified as areas of cannabis plantation for eventual distribution to various parts of the country and smuggling abroad. In some cases, the clergy (priests and deacons) in monasteries are also known to use marijuana to help them enhance performance in their education, and to keep them awake during prayers. Although weakly controlled in Ethiopia, cannabis is obviously listed as an illicit "street" drug. In limited quarters, such as monasteries, its use seems to be accepted. It is also incorporated into some traditional herbal formulas.[9]

The health and other risks associated with the use of marijuana in Ethiopia far outweigh any local medical and other benefits attributed to it. Considering its potential to be abused, and the possibility of its interactions with a number of conventional drugs mentioned in the interaction section, the use of marijuana may not only lead to a self-destructive addictive path, but also may compromise the therapy of patients, especially those who are put on psychoactive medications.

References:

1. Abebe D, Ayehu A. Medicinal Plants and Enigmatic Health Practices of Northern Ethiopia. Addis Ababa: B.S.P.E; 1993; p 401.
2. Tadesse M, Demissew S. Medicinal Ethiopian Plants: Inventory, Identification, and Classification. In: Plants Used in African Traditional Medicine as Practiced in Ethiopia and Uganda, Botany 2000: *NAPRECA Monograph Series No. 5*. Edwards S, Zemede A (eds). Addis Ababa,

Ethiopia: NAPRECA, Addis Ababa University; 1992, pp 1-19.

3. Abate G. (Demissew S, ed.). *Etse Debdabe* (Ethiopian Traditional Medicine). Addis Ababa, Ethiopia: Biology Department, Science Faculty, Addis Ababa University; 1989, p 182.
4. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database*. 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 707-708.
5. Brinker F. Herb Contraindications and Drug Interactions. Third Edition. Sandy, OR: Eclectic Medical publications, 2001, pp 142-143.
6. Klasco RK (Ed.). DRUG-REAX® System. Thomson Micromedex. Greenwood Village, CO: Thomson Healthcare, Inc. (2006 Edition).
7. Fackelmann K. Marijuana on Trial. Is marijuana a dangerous drug or a valuable medicine? *Sc News* 1997; 151:178-183.
8. Peirce A. The American Pharmaceutical Association Practical Guide to natural Medicines. New York: Stonesong Press; 1999; pp 413-416.
9. Kassay M, Sherief HT, *et al* Knowledge of "drug" use and associated factors as perceived by health professionals, farmers, the youth and law enforcement agencies in Ethiopia. *Ethiop J Health Dev* 1999; 13(2): 141-149.

Myrtle

Local (vernacular) names: Addes (A; G); addisa, codo (O)

Scientific name: *Myrtus communis* L

Family: Myrtaceae

Common names: Myrtle

Medicinal Uses:

In Ethiopia: Leaf, for dysentery, fever, and as a hair fragrance; seed, for ascariasis, fever, stomachache, and taeniasis.[1]

Outside of Ethiopia: For acute and chronic infections of the respiratory tract such as bronchitis, whooping cough, tuberculosis of the lung, bladder conditions, diarrhea, and worm infestations.[2]

Herb-Drug Interactions:

Insulin/Oral hypoglycemic agents: Extract of myrtle decreases hyperglycemia in chemically induced diabetic conditions.[3]

Clinical Management:

Blood glucose levels should be monitored when myrtle is taken concurrently with ant-diabetic medications.

References:

1. Fullas F. Ethiopian Traditional Medicine: Common Medicinal Plants in Perspective, Sioux City, IA, USA; 2001, p 53.
2. Gruenwald J, Brendler T, Jaenicke C. (Scientific Eds.) PDR for Herbal Medicines. 1st ed. Montvale, NJ: Medical Economics Company; 1998; pp 987-988.
3. Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY: Church Street Books, 2005, p 227.

Nutmeg

Local (vernacular) names: Gewz

Scientific name: *Myristica fragrans* Houtt.

Family: Myristicaceae

Common names: Nutmeg: mace, nux moscahata, rou dou kou;
Mace: macis, muscade

Medicinal Uses:

In Ethiopia: For pneumonia.[1]

Outside of Ethiopia: Orally for diarrhea, spasms, flatulence, gastric mucosal inflammation, as a tonic, and hallucinogenic. Topically, as an analgesic, for rheumatism, stimulating menstrual flow, insomnia, as an abortifacient. Nutmeg, topically for mouth sores, mixed with pork for paralysis, rheumatism, as an aphrodisiac, and for mange. Mace, topically for rheumatism.[2]

Summary of Culinary Uses in Ethiopia:

To accent the taste of *wot*, and as an ingredient in spice blends.[1]

Herb-Drug Interactions:

Anticoagulants and drugs that increase the risk of bleeding: Nutmeg may increase the risk of bleeding when used along with anticoagulants and other drugs that have the potential to cause bleeding.[3]

CYP1A1/2, CYP2B1/2, CYP2E1: Studies suggest that the constituent myristicin acts as an inducer of cytochrome P450 enzyme.[2] It induces specifically CYP1A1/2, CYP2B1/2, and CYP2E1, thus decreasing the serum levels of drugs which are metabolized by these enzymes.[3]

Flunitrazepam: The interaction between the drug and nutmeg has been implicated in the death of a 55-year old female.[3]

Haloperidol: Nutmeg enhances haloperidol-induced catalepsy.[3]

MAOIs: When used with monoamine oxidase inhibitors (MAOIs), nutmeg potentiates the activity of the latter.[2]

Clinical Management:

Caution should be exercised if nutmeg and a monoamine oxidase inhibitor are taken together. Early symptoms of MAO inhibitor toxicity, such as irritability, hyperactivity, anxiety, hypotension, vascular collapse, insomnia, restlessness, dizziness, faintness, drowsiness, hallucinations, trismus, sweating, tachypnea, tachycardia, movement disorders (e.g., grimacing, opisthotonus), and severe headache, should be monitored.[4]

References:

1. Fullas F. Spice Plants in Ethiopia: Their Culinary and Medicinal Applications. Sioux City, IA, USA; 2003, pp 106-109.
2. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database*. 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 764-765.
3. Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY: Church Street Books, 2005, pp 235-236.
4. Klasco RK (Ed.). DRUG-REAX® System. Thomson Micromedex. Greenwood Village, CO: Thomson Healthcare, Inc. (2006 Edition).

Olive

Local (vernacular) names: Woyra (A); wiri (Awi)

Scientific name: *Olea europaea* subsp *cuscipidata* (Wall ex DC.)

Family: Oleaceae

Common names: Olive, lucca

Medicinal Uses:

In Ethiopia: Bark, for malaria;[1] oil, for stomach problems;[2] root, for hemorrhoids.[3]

Outside of Ethiopia: Leaf for conditions caused by or associated with a virus, retrovirus, bacterium, or protozoan, including common cold, meningitis, Epstein-Barr Virus (EBV), encephalitis, herpes I and II, human herpes virus 6 and 7, shingles, HIV/ARC/AIDS, chronic fatigue, hepatitis B, pneumonia, tuberculosis, gonorrhea, malaria, dengue, bacteremia, severe diarrhea, blood poisoning, dental, ear, urinary tract and surgical infections; other uses, for high blood pressure, diabetes, enhancement of renal and age-related digestive functions, as a diuretic and antipyretic. Oil, for the prevention of cardiovascular diseases, breast cancer, rheumatoid arthritis, migraine headache, firming breasts, bile duct and gallbladder inflammation, gall stones, jaundice, flatulence, meteorism, as a cleanser, purifier and mild laxative. Topically, for softening ear wax, treating ringing and pain in ears, as nasal drops, for wound dressing, minor burns, psoriasis, and stretch marks due to pregnancy.[4]

Herb-Drug Interactions:

Antihypertensive drugs: Consumption of olive oil might allow for a reduction of antihyepertensive drug doses in people treated for hypertension. In a double-blind, cross-over trial, 30-40 gms of olive oil daily for 6 months lowered blood pressures, and allowed for a 50% reduction in antihypertensive drug doses in a

group of patients with mild to moderate to high blood pressure. The drugs in the trial included the beta-blocker atenolol, the calcium channel blocker nifedipine, the angiotensin converting enzyme inhibitor (ACEI) lisinopril, the alpha-blocker doxazosin, and the thiazide diuretic hydrochlorothiazide.[4]

Insulin/Oral hypoglycemic agents: Oleuropeoside, a constituent of olive leaf, has hypoglycemic activity. Thus, ingesting the herb may increase insulin secretion in response to glucose, and increase in peripheral uptake of glucose.[5]

Clinical Management:

Blood glucose levels should be closely monitored, since olive oil is claimed to have hypoglycemic effect, which may be pronounced when used concurrently with antidiabetic drugs.[4]

References:

1. Abbink J. Medicinal and ritual plants of the Ethiopian southwest; an account of recent research. *IK & DM*. 1995; 3(2): 6-8.
2. Desissa D. A preliminary economic valuation of medicinal plants in Ethiopia: Trade, volume and price. *In*: Conservation and Sustainable Use of Medicinal Plants in Ethiopia. Zewdu M, Demissie A, eds, Addis Ababa: Institute of Biodiversity Conservation and Research; 2001, pp 176-187.
3. Tadesse M, Demissew S. Medicinal Ethiopian Plants: Inventory, Identification, and Classification. In: Plants Used in African Traditional Medicine as Practiced in Ethiopia and Uganda, Botany 2000: NAPRECA Monograph Series No. 5. Edwards S, Zemede A (eds). Addis Ababa, Ethiopia: NAPRECA, Addis Ababa University; 1992, pp 1-19.
4. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database*. 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 776-768.
5. Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY: Church Street Books, 2005. p 241.

Onion

Local (vernacular) names: Qey shinkurt (A); bsha shinkurt (G); ferenja tumwa (Wel); keshertana (Had);qeyh shinkurti (T); qullubbii diimaa (O); sunkutta (Kemb)

Scientific name: *Allium capa* L.

Family: Liliaceae

Common name(s): Onion, shallots

Medicinal Uses:

In Ethiopia: Bulbs, orally for headache; juice, for eye problems[1]

Outside of Ethiopia: Orally, for loss of appetite, atherosclerosis, dyspepsia, fever, colds, cough, bronchitis, hypertension, tendency toward infection, inflammation of the mouth and the pharynx, asthma, angina, stimulation of gallbladder, dehydration, as a menstrual aid, diabetes, insect bites, wounds, light burns, furuncles, warts, bruises, flatulence, as an anthelminthic and diuretic.

Culinary Uses in Ethiopia:

As a spice for cooking, vegetable, an ingredient in *berbere* and various meat-based dishes.[1]

Herb-Drug Interactions:

Anti-diabetes drugs: Onion might enhance anti-diabetes drug effects and alter blood sugar control.[2]

Antiplatelet drugs: When used with antiplatelet drugs, it may also enhance the antiplatelet activity, and increase the risk of bleeding.[2]

Anti-hypertensives: Dried onion has antihypertensive effect, which may be additive with antihypertensive drugs.[3]

Aspirin: Concomitant intake of onion with aspirin might augment onion allergy. In one case, severe urticaria and swelling were reported in a person with a known mild allergy to onion.[2]

CYP1A1, CYP2B, CYP2E1: Onion powder induces CYP1A1 and CYP2B, but inhibits CYP2E1. Therefore, serum levels of drugs metabolized by CYP1A1 and CYP2B may be decreased, while those that are metabolized by CYP2E1 may be increased.[3] (see Appendix IV)

Clinical Management:

Patients who are on insulin and oral hypoglycemic medications should be monitored for blood glucose levels.[3] The effects of the other drugs should also be closely monitored.

References:

1. Fullas F. Spice Plants in Ethiopia: Their Culinary and Medicinal Applications. Sioux City, IA, USA; 2003, pp 36-39.
2. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database*. 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 779-780.
3. Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY: Church Street Books, 2005, p 242.

Peppermint

Local (vernacular) names: Nanna (A); nanna (O);
semhal (T) for *Mentha longifolia*;
koricha leg (O) for *M. aquatica*

Scientific name: *Mentha* x *piperita* L.

Family: Labiatae

Common names: Black mint, brandy mint, lamb mint, peppermint, white mint

Medicinal Uses:

In Ethiopia: *Mentha* sp. for common cold and headache[1]

Outside of Ethiopia: Leaf (*M. piperita*), for loss of appetite, spasm of the gastrointestinal tract, gall bladder, and bile ducts, flatulence, gastritis, enteritis, nausea, vomiting, morning sickness, respiratory infections, dysmenorrhea. Peppermint oil, orally for colds, cough, inflammation of the mouth, pharynx, liver and gall bladder complaints, irritable bowel syndrome, cramps of the upper respiratory and bile ducts, as an antipyretic, and antiflatulent, and for tension headache. Topically, for headache, mylagias, toothache, mucosa inflammation, rheumatic conditions, pruritis, urticaria, as an antibacterial, antiviral, and mosquito-repellant. Inhalation, for cough and cold.[2]

Culinary Uses in Ethiopia:

To flavor teas.[1]

Herb-Drug Interactions:

Cimetidine: When taken with cimetidine, peppermint inhibits oxidative metabolism, which results in increased menthol-glucuronide excretion. Menthol conjugation with gulucuronic acid may be dose-dependent.[3]

Cyclosporine: In rats, peppermint has been shown to enhance

cyclosporine bioavailability.[3]

CYP1A2 and CYP2E: Peppermint tea decreases the activity of CYP1A2 and CYP2E enzymes by 24% and 60%, respectively. It is not clear if this effect is true in humans.[4]

Felodipine and simvastatin: In a cross-over investigation involving 12 healthy patients, peppermint oil increased the bioavailabilty of felodipine and simvastatin.[3] Peppermint oil is thought to inhibit gut wall metabolism (through CYP3A4) of both felodipine and simvastatin. In the case of felodipine, 10 mg of extended-release (ER) form alone with 300 ml of water, and 10 mg of ER felodipine, 300 ml water plus 600 mg peppermint oil were in turn administered to separate groups of subjects. In the felodipine/water/peppermint group, the area under the curve (AUC) was increased 40%. The same procedure was repeated replacing felodipine with simvastatin. In the simvastatin/water/peppermint group, the area under the curve was increased 30%.[5]

Caffeine: Peppermint may decrease the absorption of caffeine. In a study involving 11 healthy subjects, when a single 200-mg oral dose of menthol (a constituent of peppermint) was administered, it was observed that there was a 75% increase in the time to reach peak concentration.[5]

Iron: Peppermint tea decreases the absorption of non-heme iron by 84%, due to its polyphenolic content.[4]

Warfarin: Ingestion of menthol-containing cough drops and warfarin appeared to reduce the International Normalized Ratio (INR) to sub-therapeutic range in a patient receiving anti-coagulation therapy with warfarin.[6]

Clinical Management:

Caution is advised when using peppermint oil along with calcium channel blockers, until this herb-drug interaction has been better characterized. In patients who take medications containing menthol (also a constituent of peppermint) while receiving anticoagulant therapy with warfarin, INR should be closely monitored. Coagulation parameters should be reassessed periodically during concurrent therapy. Adjustment of warfarin dose may be

required in order to maintain a desired level of anticoagulation.[6] Concurrent use of peppermint oil with simvastatin and felodipine should be avoided.[7]

References:

1. Fullas F. Spice Plants in Ethiopia: Their Culinary and Medicinal Applications. Sioux City, IA, USA; 2003, pp 99-105.
2. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database*. 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 817-820.
3. DerMarderosian A, Beutler JA, eds. Peppermint. *The Review of Natural Products*. St. Louis, MO: Facts and Comparisons., July 2002.
4. Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY: Church Street Books, 2005, p 252.
5. DerMarderosian A, Beutler JA, eds. Peppermint. *The Review of Natural Products*. St. Louis, MO: Wolters Kluwer Health, Inc., July 2004.
6. Klasco RK (Ed.). DRUG-REAX® System. Thomson Micromedex. Greenwood Village, CO: Thomson Healthcare, Inc. (2006 Edition).
7. DerMarderosian A, Beutler JA, eds. Evidence-Based Herb-Drug Interactions. *The Review of Natural Products*. St. Louis, MO: Wolters Kluwer Health, Inc., July 2004.

Plantain

Local (vernacular) names: Gorteb, kura wesfe (A)

Scientific name: *Plantago lanceolata* L.

Family: Plantaginaceae

Common names: Black psyllium, blond plantago, flea seed, plantain, psyllium seed, Spanish psyllium

Medicinal Uses:

In Ethiopia: Whole plant, for taeniasis;[1] leaf, for trachoma;[2] leaf powder (mixed with leaf powder from *Ajuga remota*), for rheumatism.[3]

Outside of Ethiopia: For local inflammation, soar throats, as a laxative,[4] common cold, cough, bronchitis, inflammation of the mouth and pharynx, inflammation of the skin, tendency to infection, internally for catarrh of the respiratory tract. Externally, for inflammatory reactions of the skin, juice for wounds and inflammations, and as a hemostyptic.[5]

Herb-Drug Interactions:

Antidiabetic drugs: Simultaneous use of psyllium and anti-diabetic drugs may result in increased risk of hypoglycemia.[6]

Carbamazepine: With the ingestion of plantain a decrease in carbamazepine absorption has been reported.[7] Psyllium suspended in 200 ml of water was added to a 200-mg carbamazepine regimen of four healthy volunteers. It was observed that the C_{max} with carbamazepine alone was 2.33 micrograms/hour (mcg/hr), while with psyllium added, it decreased to1.11 mcg/ml. The AUC was 45.43 mcg/ml with carbamazepine alone, while with psyllium added it was 25.03 mcg/ml. The T_{max} was increased from 5.52 hours (with carbamazepine alone) to 24.14 hours (with carbamazepine plus psyllium). The bioavailability was reduced to 55%. Simultaneous use of psyllium and anti-diabetic drugs may result in increased risk of

hypoglycemia.[6]

Levothyroxine: It has been reported that intake of psyllium reduced the absorption of levothyroxine, likely due to adsorption by the fiber.[8]

Lithium: The use of psyllium with lithium salts may inhibit absorption of lithium in the GI tract, and thus leading to lower plasma concentrations. One teaspoonful (5 ml) of psyllium in water twice daily reduced the absorption of lithium in one case, although this effect did not occur if lithium was taken one or more hours before psyllium.[7]

Oral medications: The absorption from the GI tract of oral medication, minerals, such as calcium, iron and zinc, vitamins (e.g., vitamin B-12), cardiac glycosides and coumarin derivatives may be retarded. Also, carbohydrate absorption may be decreased, leading to low sugar levels in Type I diabetic patients.[7]

Clinical Management:

If patients are treated with carbamazepine and psyllium, their administration times should be separated as far as possible, and plasma levels of carbamazepine should be monitored.. Blood glucose levels should also be monitored closely. Psyllium may delay absorption of glucose from meals, leading to less postprandial glucose than expected, and potentially allowing a reduced dosage of antidiabetic medications. Administration of psyllium and lithium should be separated by at least two hours to reduce the likelihood of interaction.[6]

References:

1. Desta B. Ethiopian traditional herbal drugs. Part I. Studies on the toxicity and therapeutic activity of local taenicidal medications. *J Ethnopharmacol* 1995; 45: 27-33.
2. Tadesse M, Demissew S. Medicinal Ethiopian Plants: Inventory, Identification, and Classification. In: Plants Used in African Traditional Medicine as Practiced in Ethiopia and Uganda, Botany 2000: *NAPRECA Monograph Series No. 5*. Edwards S, Zemede A (eds). Addis Ababa, Ethiopia: NAPRECA, Addis Ababa University; 1992, pp 1-19.
3. Abebe D, Ayehu A. Medicinal Plants and Enigmatic Health Practices of

Northern Ethiopia. Addis Ababa: B.S.P.E; 1993; p 249.

4. DerMarderosian A, Beutler JA, eds. Plantain. *The Review of Natural Products*. St. Louis, MO: Wolters Kluwer Health, Inc., July 2004.
5. Gruenwald J, Brendler T, Jaenicke C. (Scientific eds.) PDR for Herbal Medicines. 1st ed. Montvale, NJ: Medical Economics Company; 1998; pp 1050-1051.
6. Klasco RK (Ed.). DRUG-REAX® System. Thomson Micromedex. Greenwood Village, CO: Thomson Healthcare, Inc. (2006 Edition).
7. Blumenthal M. Interactions Between Herbs and Conventional Drugs: Introductory Considerations. *HerbalGram* 2000; 49:52-63.
8. Brinker F. Herb Contraindications and Drug Interactions. Third Edition. Sandy, OR: Eclectic Medical publications, 2001, pp 165-166.
9. Edwards, SB. Crops with wild relatives found in Ethiopia. In: Plant Genetic Resources of Ethiopia. Engels JMM, Hawkes JG, Worede eds. New York, NY: Cambridge University Press; 1991; pp 42-74.

Pomegranate

Local (vernacular) names: Roman (A)

Scientific name: *Punica granatum* L

Family: Punicaceae

Common names: Grandada, grenadier, Shi Liu Gen Pi, Shi Liu Pi

Medicinal Uses:

In Ethiopia: Bark, for taeniasis;[1] bark and leaves added to other plants, for ascariasis;[2] fruit skin, for diarrhea;[2] leaf, for taeniasis and liver disorders; root, as an anthelminthic; seed, for headache[3]

Outside of Ethiopia: For tapeworm infestations, opportunistic intestinal worms, as an astringent for diarrhea and dysentery, and as an abortive. Topically, for soar throat (as a gargle) and hemorrhoids.[4]

Herb-Drug Interactions:

Oral medications: Due to its high tannin content, pomegranate may precipitate in the GI tract some orally administered drugs.[4]

Iron supplements: The tannin constituent of pomegranate may interact with iron supplementation products to form a non-absorbable complex. However, there are also claims that this type of complexes may dissolve in the acidic environment of the stomach.[5]

Management:

It is advisable to separate administration of oral drugs and pomegranate by the longest time possible. It is unknown to what extent the tannin in pomegranate clinically affects iron absorption. It is safer to separate the administration times of pomegranate and iron products by one to two hours.[5]

References:

1. Abate G. (Demissew S, ed.). *Etse Debdabe* (Ethiopian Traditional Medicine). Addis Ababa, Ethiopia: Biology Department, Science Faculty, Addis Ababa University; 1989, p 172
2. *Ibid*. p 72.
3. Jansen PCM. Spices, Condiments and Medicinal Plants in Ethiopia, their Taxonomy and Agricultural Significance. Wageningan:PUDOC;1981; p 276.
4. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database*. 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 849-850.
5. Klasco RK (Ed.). DRUG-REAX® System. Thomson Micromedex. Greenwood Village, CO: Thomson Healthcare, Inc. (2006 Edition).

Pumpkin

Local (vernacular) names: Duba (A; Saho; Tya); ye'bahr hareg, ye'qura hareg, zkuni (A;T); bohot (S); botu (Gamb); bukeh, buko (Kef); buko dabaa qula (O); hamham, wushsh (T)

Scientific name: *Cucurbita pepo* L.

Family: Cucurbitaceae

Common names: Pumpkin

Medicinal Uses:

In Ethiopia: Seeds, for taeniasis and as a laxative[1]

Outside of Ethiopia: For immobilization and expulsion of intestinal worms and parasites, prostate gland disorders,[2] irritable bladder, micturation problems (associated with prostate conditions), and kidney inflammation.[3]

Herb-Drug Interactions:

Warfarin: Two patients stabilized on warfarin experienced increase in INR after taking an herbal combination containing cucurbita. In both patients, the INR returned to normal after the herbal product was discontinued. However, there was no conclusive evidence for the link between the cucurbita component and the increase in INR.[4]

Clinical Management:

Caution should be exercised in patients ingesting pumpkin seeds (cucurbita) and warfarin together. The INR, and signs and symptoms of excessive bleeding should be monitored.[4]

References:

1. Kloos H., Tekle A., W Yohannes L, et al. Preliminary studies of

traditional medicinal plants in nineteen markets in Ethiopia: Use patterns and public health aspects. *Ethiop Med J* 1978; 16: 33-43.

2. DerMarderosian A, Beutler JA, eds. Pumpkin. *The Review of Natural Products*. St. Louis, MO: Wolters Kluwer Health, Inc., July 2004.
3. Gruenwald J, Brendler T, Jaenicke C. (Scientific eds.) PDR for Herbal Medicines. 1st ed. Montvale, NJ: Medical Economics Company; 1998; pp 784-785.
4. Klasco RK (Ed.). DRUG-REAX® System. Thomson Micromedex. Greenwood Village, CO: Thomson Healthcare, Inc. (2006 Edition).

Rue

Local (vernacular) names: Tenadam; adam, taladam, gulla (A); dehn, taenadam (T); talatam, tallers, discharata (O)

Scientific name: *Ruta chalepensis* L. or *Ruta graveolens* L.

Family: Rutaceae

Common names: Common rue, countryman's treacle, garden rue, German rue, Herb-of-Grace, herbygrass, raute, rusda, Rue officinale, Rutae folium, Ruta herba

Medicinal Uses:

In Ethiopia: *R. chalepensis*-leaf and fruit, for ascariasis, common cold, *mitch*, and stomachache;[1] as an additive to many remedies;[2] fruit, for diarrhea; whole plant, for influenza; other uses, for ear pain, heart pain, and intestinal disorders.[3]

Outside of Ethiopia: *R. graveolens*; orally for menstrual disorders and discomfort, as a uterine stimulant and abortifacient, for loss of appetite, dyspepsia, circulatory disorders, atherosclerosis, heart palpitations, nervousness, hysteria, fever, feverish infectious diseases, cramps, hepatitis, diarrhea, pleurisy, headache, neuralgia, afflictions and weaknesses of the eyes, respiratory complaints, arthritis, intestinal worm infestations, epilepsy, multiple sclerosis, Bell's palsy, cancer of the mouth, as an antispasmodic, diuretic, antibacterial, antifungal, hemostatic, and contraceptive. Topically, for arthritis, dislocations, sprains, injuries of the bone, inflammation of the pharyngeal cavities, earaches, toothaches, headaches, tumors, warts, and as an insect-repellant.[4]

Culinary Uses in Ethiopia:

Fruits, an ingredient in the popular spice mix; leaves in the preparation of *irgo* (the traditional equivalent of yogurt), to flavor special coffee brew (*kuti*) and creamed coffee.[3]

Herb-Drug Interactions:

Psoralen Ultraviolet A (PUVA) Therapy: Rue might increase the phototoxic response to PUVA therapy, which involves the use of psoralen and long ultra-violet irradiation. The 5-methoxy psoralen content of rue is thought to be responsible for the phototoxic response. There is one case report where such a response occurred after a person ingested rue.[4]

Warfarin: There is a speculation that coumarins in rue may lead to potential interactions with warfarin.[5]

Clinical Management:

No specific management has been reported in the literature. Although no major interactions have been reported, considering the wide spectrum of its activities, it has been suggested to avoid co-administration rue and drugs such as anti-hypertensive agents, CNS depressants and stimulants, photosensitizing agents, and stimulant laxatives.[6]

References:

1. Kloos H., Tekle A., W Yohannes L, et al. Preliminary studies of traditional medicinal plants in nineteen markets in Ethiopia: Use patterns and public health aspects. *Ethiop Med J* 1978; 16: 33-43.
2. Tadesse M, Demissew S. Medicinal Ethiopian Plants: Inventory, Identification, and Classification. In: Plants Used in African Traditional Medicine as Practiced in Ethiopia and Uganda, Botany 2000: *NAPRECA Monograph Series No. 5*. Edwards S, Zemede A (eds). Addis Ababa, Ethiopia: NAPRECA, Addis Ababa University; 1992, pp 1-19.
3. Fullas F. Spice Plants in Ethiopia: Their Culinary and Medicinal Applications. Sioux City, IA, USA; 2003, pp 133-137.
4. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database*. 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 914-916.
5. Brinker F. Herb Contraindications and Drug Interactions. Third Edition. Sandy, OR: Eclectic Medical publications, 2001, p 170.
6. Philp RB. Herbal-Drug Interactions and Adverse Effects. New York, NY: McGraw-Hill; 2004: p 221.

Safflower

Local (vernacular) names: Suf (A); sufi (O)

Scientific name: *Carthamus tinctorius* L.

Family: Asteraceae (Compositae)

Common names: Safflower

Medicinal Uses:

In Ethiopia: As an ingredient in multi-component traditional formulas;[1] fruit, for heart conditions (*lib dikam*);[2] mixed with other medicinal plants, for heart conditions (*lib dikam*);[3] seed, for stomachache[4]

Outside of Ethiopia: For reducing the risk of cardiovascular diseases and preventing atherosclerosis, fever, tumors, coughs, bronchial conditions, blood stasis, blood invigoration, pain, amenorrhea, painful menses, stimulating menstruation, coronary heart disease, chest pain, traumatic injuries, inducing sweating, as a laxative, purgative, stimulant, antidepressant, abortifacient, and expectorant.[5]

Herb-Drug Interactions:

Antiplatelet agents, low molecular weight heparins, and thrombolytic agents: When used concomitantly with anticoagulants, safflower might theoretically increase the effects and adverse effects of anticoagulant drugs.[5] In a study, safflower oil was shown to significantly decrease reversible thrombin-induced and irreversible adenosine diphosphate (AD)-induced platelet aggregation in 6 healthy male volunteers, without affecting bleeding time. The clinical significance of this interaction, however, is not known.[6]

Clinical Management:

No clinical intervention has been recommended in the literature. As a general precaution, it is advisable to monitor patients

for unexpected bleeding when safflower is used in conjunction with medications that affect bleeding time.

References:

1. Abebe D, Ayehu A. Medicinal Plants and Enigmatic Health Practices of Northern Ethiopia. Addis Ababa: B.S.P.E; 1993.
2. Tadesse M, Demissew S. Medicinal Ethiopian Plants: Inventory, Identification, and Classification. In: Plants Used in African Traditional Medicine as Practiced in Ethiopia and Uganda, Botany 2000: *NAPRECA Monograph Series No. 5*. Edwards S, Zemede A (eds). Addis Ababa, Ethiopia: NAPRECA, Addis Ababa University; 1992, pp 1-19.
3. Abate G. (Demissew S, ed.). *Etse Debdabe* (Ethiopian Traditional Medicine). Addis Ababa, Ethiopia: Biology Department, Science Faculty, Addis Ababa University; 1989, p 171.
4. Jansen PCM. Spices, Condiments and Medicinal Plants in Ethiopia, their Taxonomy and Agricultural Significance. Wageningan:PUDOC;1981; p 263.
5. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database*. 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 921-922.
6. Klasco RK (Ed.). DRUG-REAX® System. Thomson Micromedex. Greenwood Village, CO: Thomson Healthcare, Inc. (2006 Edition).

Tamarind

Local (vernacular) name (s): Homar (A); Rokai (O); Rogi (Sodo); Tamare-hindi (Arabic)

Scientific name: *Tamarindus indica* L.

Family: Leguminosae or Fabaceae

Common name (s): Tamarind, tamarindo, imlee

Medicinal Uses:

In Ethiopia: Fruits, as laxatives and for fever; pulp, for diarrhea, dysentery (the seeds also), malaria, wounds, and hemorrhoids;[1] fruit, for stomach pain.[2]

Outside of Ethiopia: Orally, for chronic and acute constipation, liver and gall bladder disorders, and fever. Topically, as cast (with paste from seeds) for broken bones.[3]

Herb-Drug Interactions:

Aspirin: The bioavailability of aspirin may be increased with the consumption of tamarind, increasing the risk of gastrointestinal bleeding.[4]

Chloroquine: *Tamarindus indica* decreases chloroquine plasma levels, reducing its therapeutic effects.[5]

Clinical Management:

Patients should be advised to avoid taking chloroquine with beverages prepared from *Tamarindus indica*.[5] Excessive use of tamarind should be avoided in patients who take aspirin or other NSAIDs regularly.[4]

References:

1. Fullas F. Spice Plants in Ethiopia: Their Culinary and Medicinal Applications. Sioux City, IA, USA; 2003, p 144.
2. Abbink J. Medicinal and ritual plants of the Ethiopian southwest; an

account of recent research. *IK & DM*. 1995; 3(2): 6-8.

3. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database*. 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 1017-1018.
4. Philp RB. Herbal-Drug Interactions and Adverse Effects. New York, NY: McGraw-Hill; 2004: p 246-247.
5. DerMarderosian A, Beutler JA, eds. Evidence-Based Herb-Drug Interactions. *The Review of Natural Products*. St. Louis, MO: Wolters Kluwer Health, Inc., July 2004.

Turmeric

Local (vernacular) names: Ird (A; O)

Scientific name: *Curcuma longa* L.

Family: Zingiberaceae

Common names: Curcuma, curcumin, Indian saffron, turmeric, yu jin

Medicinal Uses:

In Ethiopia: Grated roots, topically for "crying eyes" in children.[1]

Outside of Ethiopia: Orally, for dyspepsia, hemorrhage, jaundice, hepatitis, flatulence, abdominal bloating, feelings of fulness after meals, loss of appetite, liver and gall bladder problems, headaches, abdominal pains, chest infections, fever, diarrhea, and amenorrhea, intermittent fever, colds, worms, leprosy, kidney inflammations, cystitis, and cancer. Topically, for analgesia, ringworm infections, bruising leech bites, festering eye infections, inflammatory skin conditions, inflammation of the oral mucosa, and for infected wounds.[2]

Culinary Uses in Ethiopia:

As a condiment for various stews and pastry.[1]

Herb-Drug Interactions:

Amphotericin B: Curcumin, a constituent of turmeric, enhances the anti-mycotic effects of amphotericin B.[3]

Antidepressants: Turmeric may have additive effect with antidepressants such as MAOIs.[3]

Antiplatelets/anticoagulants/thrombolytic agents/low molecular weight heparins: Curcumin may increase the risk of bleeding when used concurrently with antiplatelet drugs. Curcumin has been shown to inhibit platelet aggregation in vitro and in animals. Risk of bleeding may also be increased, when used in conjunction

with anticoagulants, thrombolytic agents and low molecular weight heparins.[4]

Cyclosphosphamide: Cucumin inhibits the antiapoptotic effects of cyclophosphamide.[3]

Cyclosporine: Curcumin blocks cyclosporine-resistant CD28 co-stimulatory pathway of T-cell proliferation. Curcumin may be a useful adjunct to chemotherapy. It has no effect on cyclosporine-induced cholestasis and hypercholesterolemia.[3]

Doxorubucin: Cucumin inhibits the antiapoptotic effects of doxorubucin.[3]

Fluconazole: Cucumin enhances the antimycotic effects of fluconazole.[3]

5-fluorouracil: Curcumin enhances 5-fluorouracil activity.[3]

Indomethacin: An alcoholic extract of turmeric given 30 minutes prior to indomethacin administration reduced the frequency of duodenal ulcers induced by indomethacin. It was also shown that it has protective effect against ulcers induced by reserpine.[5]

Insulin/oral hypoglycemic agents: Turmeric reduces blood glucose levels and hemoglobin A1c (Hb A1c). Curcuminoids and the sesquiterpene constituents of turmeric have hypoglycemic effect, and therefore may potentiate the effects of antidiabetic medications.[3]

Mechlorethamine: Curcumin inhibits the antiapoptotic effects of mechlorethamine.[3]

Methimazole: An extract of turmeric decreases methimazole-induced hypothyroid effects.[3]

Vinblastine: Cucuminoids from turmeric increase cell sensitivity to vinblastine.[3]

Clinical Management:

Caution is advised if curcumin and antiplatelet agents (or anticoagulants, thrombolytic agents, LMWHs) are used concurrently. Signs and symptoms of excessive bleeding should be monitored.[4]

In Ethiopia, turmeric is mainly used more as a spice than as a medicinal agent. Its use as medicinal herb is restricted to topical use only. However, since it is used commonly as a spice orally, patients on the above conventional drugs should be monitored for interactions.

References:

1. Fullas F. Spice Plants in Ethiopia: Their Culinary and Medicinal Applications. Sioux City, IA, USA; 2003, pp 88-91.
2. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database*. 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 1045-1046.
3. Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY: Church Street Books, 2005, pp 324-326.
4. Brinker F. Herb Contraindications and Drug Interactions. Third Edition. Sandy, OR: Eclectic Medical publications, 2001, p 194-195.
5. Klasco RK (Ed.). DRUG-REAX® System. Thomson Micromedex. Greenwood Village, CO: Thomson Healthcare, Inc. (2006 Edition).

Verbena

Local (vernacular) names: Attuch, etse mengist, akkoragag (A); serrufit (T)

Scientific name: *Verbena officinalis* L.

Family: Verbenaceae

Common names: Bastard balm, blue vervain, common verbena, common vervain, devil's medicine, eisenkrauter's plant, European vervain, herb of grace, herb of the cross, holywort, Juno's tears, Indian hyssop, ma bian cao, pigeon's grass, pigeon weed, Simpler's joy, turkey grass, verbena herba

Medicinal Uses:

In Ethiopia: Juice, for eye disease; juice from leaf and root, for liver disease; leaf, for dysentery, eczema, indigestion, and mumps; root, for heart disease, heart pain, indigestion, stomachache, and tonsilitis;[1] seed mixed with *araqe,* for *gommit*, *yeQola Qusil*, and *chewe*;[2] root, for elephantiasis and lymphadenopathy.[3]

Outside of Ethiopia: Orally, for soar throats and pharyngeal inflammations, respiratory diseases such as asthma whooping cough, angina, depression, melancholia, hysteria, generalized seizures, gallbladder pain, fever, debility of convalescence after fevers, pains, spasms, exhaustion, nervous conditions, digestive disorders, liver and gallbladder diseases, jaundice, kidney and urinary tract ailments and diseases, menopausal complaints, irregular menstruation, enhancing lactation during nursing, arthritic conditions, gout, metabolic disorders, anemia, and edema secondary to weak heart. Topically, for poorly healing wounds, abscesses and burns, cold symptoms and oral/pharyngeal diseases (as a gargle), arthritis, rheumatism, dislocations, contusions, itching, and minor burns.[4]

Herb-Drug Interactions:

Anticoagulants/warfarin: Verbena contains variable amounts of vitamin K, which counteracts the anticoagulant effect of warfarin.[5]

Doxycycline: Concurrent use of an herbal combination containing verbena with doxycycline and a topical decongestant might improve the outcome of conventional (antibiotic/decongestant) therapy for bacterial sinusitis.[4]

Iron: Verbena tea decreases the absorption of non-heme iron by about 59% due to its polyphenolic constituents.[5]

Levodopa: Verbena might enhance the antitremor effects of levodopa. Excessive amounts of verbena can interfere with drug therapy for hypertension, hypotension, and hormone therapy.[4]

Clinical Management:

No specific measures have been recommended in the literature. However, it may be prudent to monitor warfarin dosing in patients who take verbena. Likewise, it is advisable to monitor the effects of iron preparations and levodopa in these patients.

References:

1. Fullas F. Ethiopian traditional Medicine: Common Medicinal Plants in Perspective, Sioux City, IA; 2001, pp 69-71.
2. Tadesse M. Some medicinal plants of Central Shewa and South Western Ethiopia. *SINET: Ethiop J* Sci 1986; 9: 143-167.
3. Tadesse M, Demissew S. Medicinal Ethiopian Plants: Inventory, Identification, and Classification. In: Plants Used in African Traditional Medicine as Practiced in Ethiopia and Uganda, Botany 2000: *NAPRECA Monograph Series No. 5*. Edwards S, Zemede A (eds). Addis Ababa, Ethiopia: NAPRECA, Addis Ababa University; 1992, pp 1-19.
4. Jellin JM, Gregory P, Batz F, et al. *Pharmacists Letter/Prescriber's Letter Natural Medicines Comprehensive Database*. 3rd ed. Stockton, CA: Therapeutic Research Faculty; 2000, pp 1056-1058.
5. Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY: Church Street Books, 2005, p 330.

Withania

Local (vernacular) names: Gizawa, sabbre-golla (A); hidi budawa (O); agol (T)

Scientific name: *Withania somnifera* L

Family: Solanaceae

Common names: Withania, ashwagandha

Medicinal Uses:

In Ethiopia: Leaf, for arthritis[1] and febrile disease;[2] root, for chest pain, evil eyes, and typhoid.[2]

Outside of Ethiopia: For nausea, bronchitis, tuberculosis, arthritis, other inflammatory conditions, tumors, anemia, and fluid retention (as a diuretic or "water pill"). Topically, for skin ulcerations and swelling.[3]

Herb-Drug Interactions:

Azathiorprine: Withania prevents azathioprine-induced myelosupression. An increase in hemoglobin concentration, RBC, WBC, platelet count and weight increase occurred in mice treated with withania.[4]

CNS depressants, benzodiazepines, barbiturates: Withania may have a sedative effect. Use of withania with CNS depressants may have an additive effect. Theoretically, withania may increase the effect of benzodiazepines.[4] In rats, at a dose of 75 mg/kg, an alcoholic extract of the roots of withania potentiated pentobarbital sleeping time. Generally, withania may potentiate the effects barbiturates, due to its sedative properties.[5]

Cyclophosphamide: Alkaloid-free withania extract reduces cyclophosphamide-induced urotoxicity, myleotoxicity and immunotoxicity, without interfering with other effects of the drug.[4]

Haloperidol: Withania reduces orofacial dyskinesias induced by haloperidol, most likely via an anti-oxidant effect.[4]

Immunosuppressants: Due to the immunostimulant effect of

withania, theoretical antagonism occurs.[4]

Insulin/oral hypoglycemic agents: Roots of withania decrease blood glucose levels, thus interfering with ant-diabetic drug therapy.[4]

Paclitaxel: An extract of withania decreased the neutropenic effect of paclitaxel. The plant may prevent bone marrow suppression associated with paclitaxel.[4]

Prednisolone: Withania when used with prednisolone prevents drug-induced myelosuppression. It increases hemoglobin concentration, red blood cell count (RBC), platelet count, and weight[4].

Thyroid replacement therapy: The herb may increase serum T_4 levels.[4]

Clinical Management:

No specific recommendations have been published. Considering the potential interactions of withania with many drugs, it is advisable to follow the therapy of patients while they are on the medications listed above.

References:

1. Wilson RT, Gebre Mariam W. Medicine and Magic in Central Tigre: A Contribution to the Ethnobotany of the Ethiopian Central Plateau. *Econ Bot* 1979; 33 (1): 29-34.
2. Giday M. Ethnobotanical study of medicinal plants used by the Zay people in Ethiopia. *CBM:s Skirftserie 3: Msc-theses*; 1999.
3. Peirce A. The American Pharmaceutical association Practical Guide to natural Medicines. New York: Stonesong Press; 1999; pp 49-51.
4. Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY: Church Street Books, 2005, pp 30-31.
5. Brinker F. Herb Contraindications and Drug Interactions. Third Edition. Sandy, OR: Eclectic Medical publications, 2001, p 33.

Appendix I.

Some Medicinal Plants Known or Suspected to Interfere with P450 Isozymes*

Plants (Responsible Constituents)	Effect	P450 Isozymes affected
Black pepper	Inhibition	CYP2E1 CYP1A
Cayenne	Inhibition	CYP1A1/A2 CYP2A2 CYP3A1 CYP2C11 CYP2B1 CYP2B2 CYP2C6
Eucalyptus (1,8-cineole)	Induction	CYP2B1
Garlic oil	Inhibition	CYP2E1
Lemongrass (β-myrcene)	Induction	CYP2B
Long Pepper	Inhibition Induction	CYP2B CYP1A
Nutmeg (Methoxysafrole)	Induction	CYP1A1/2 CYP2B1/2 CYP2E1
Onion	Inhibition Induction	CYP2E1 CYP2E1

Appendix I (Continued)

Plants (Responsible Constituents)	Effect	P450 Isozymes
Peppermint	Inhibition	CYP1A2, CYP2E CYP3A4 (for the oil)
Sweet Basil (1,8-cineole)	Induction	P450 (non-specified)
Turmeric	Inhibition	CYP1A1/2, CYP2B1

*Condensed from:

Herr SM. Herb-Drug Interaction Handbook. 3rd Edition. Castleton, NY: Church Street Books, 2005.

Appendix II.

Categories and Examples of Herb-Drug Interactions*

1. Modifying Intestinal Absorption

A. Slowed and /or reduced absorption

General reduction of oral medications by hydro-colloid fibers

-Aloe vera gel
-Fenugreek seed
-Flax seed

Selective precipitation of alkaloids and minerals by tannins:

-Pomegranate rinds

B. Enhancement of absorption

-Black pepper (*P. nigrum*) and long pepper (*P. longum*): phenytoin, propranolol, and theophylline,
-Cayenne fruit (*C. frutescens*): theophylline
-Ginger rhizome (*Z. officinale*): sulfaguanidine

2. Stomach acid secretion stimulants

-Cayenne fruits
-Cinnamon bark (*C. verum*)
-Ginger rhizome
-Mustard Seed (*B. alba*, *B. juncea*, *B. nigra*)

3. Modifying blood sugar in insulin-dependent diabetics

Hypoglycemic herbs:

-Aloe gel-juice in humans
-Cassia cinnamon bark
-Cumin seed (*C. cyminum*)
-Eucalyptus leaves (*E. globulus*)
-Garlic cloves (*A. sativum*)
-Psyllium seed (*P. ovata*)
-Olive leaves (*O. europaea*)
-Onion bulbs (*A. cepa*)

Appendix II (Continued)

4. Modifying the effects of anti-coagulants

A. Increasing the potential for hemorrhage

-Warfarin or heparin metabolism inhibitors and/or anti-coagulant adjuvants:

-Garlic bulb: warfarin

B. Platelet aggregation inhibitors

-Cayenne pepper
-Clove buds
-Fenugreek seeds
-Garlic bulbs
-Ginger rhizomes
-Olive oil
-Onion plant

C. Fibrin formation inhibitors or fibrinolysis promoters

-Cayenne fruit
-Garlic bulbs
-Onion plant

5. Increasing potential for coagulation

-Mustard leaves (*B. juncea*)
-Plantain leaves (*P. major*)

6. Potentiating cardiotonic drugs through potassium loss

Stimulant laxatives:
-Aloes (dried leaf sap)
-Castor seed oil

7. Potentiating Sedative or tranquillizing drugs

-Ashawagandha: barbiturates
-Black pepper/long pepper: barbiturates
-Cayenne fruit: barbiturates

Appendix II (Continued)

8. Modifying enzyme activities in metabolic conversions

A. Inhibitors of enzymes (decrease in metabolic conversion and clearance of drugs)

-Capsaicin: *CYP1A1, 2A2, 2B/2B2, 2C6, 2C11, and 3A1*

-Diallyl sulfide in garlic cloves: *CYP1B1, CYP3A1/A2*

-Eugenol in clove buds: isoenzymes not specified

-Piperine in black pepper and long pepper: isoenzymes not specified

(Note: Acute exposure to cayenne inhibits hexobarbital metabolism in rats, while chronic exposure has the opposite effect).

B. Inducers of enzymes (increase in metabolic conversion and clearance of drugs)

-Curcumin in turmeric root-isoenzyme not specified

-Eucalyptol in eucalyptus: *CYP2B1, CYP3A2*

-Anethole on anise seed

-Fennel fruit/seed

-Organosulfides in garlic cloves and onion bulbs: *CYP1A1, 2BI/2B2*

9. Herbs acting on specific Cytochrome P450 isozymes in Phase I Metabolism

A. CYP1A2

Inducers:

-*B. olearacea* and other crucifers

-organosulfides in garlic cloves

B. CYP2E1

Inhibitors:

-Capsaicin in cayenne, chilli fruit

-Diallyl sulfide in garlic cloves

-Organosufides in garlic cloves and onion bulbs

-Phenyl isothiocyanates in *Brassica* species

Appendix II (Continued)

C. CYP3A4

Inhibitors:

-Organosulfides in garlic cloves and onion bulbs
-Quercetin from *Brassica olearacea* var. *acephala*

10. Specific enzyme influences of herbs on phase II conjugation

A. Glatathione S-transferase

Inhibitors

-Peppers (*C. annum*)

Inducers

-Anethole in anise seed
-Fennel fruit/seed
-Crucifers (e.g. *B. Olearacea*)
-Daillyl sulfides in garlic gloves
-Eugenol in clove buds
-Onion bulbs
-Organosulfides in garlic cloves and onion bulbs
-Turmeric root

B. UDP Glucouronosyltransferase

Inhibitors

-Piperine in black pepper and long pepper

Inducers

-Anethole in anise seed
-Fennel fruit/seed
-Crucifers (e.g. *B. olearacea*)
-Eugenol in clove buds
-Organosulfides in garlic cloves and onion bulbs
-Querecetin in onion bulbs
-Turmeric root

Appendix II (Continued)

C. NADP-Quinone Reductase (DT-Diaphorase)

Inducers

-Anethole in anise seed
-Crucifers (e.g. *B. olearacea*)
-Quercetin in onion bulbs or *B. olearacea*

D. Epoxide Hydrolase

Inducers

-Curcumin in turmeric root
-Quercetin in onion bulbs

E. Monoamine Oxidase-A and/or B

Inducers

-Nutmeg seed

---

*Adapted from:

Brinker F. Herb Contraindications and Drug Interactions. Third Edition. Sandy, OR: Eclectic Medical publications, 2001, pp 227-267

Appendix III.
Some common herb-drug interactions and their consequences

Herb	Interacting Drugs	Consequences of Interactions
Aloes	Antiarrythmic drugs	Increase in risk of toxicity
	Cardiac glycosides	Increase in adverse effects of cardiac glycosides
	Diuretics	Increased potassium loss
Anise	Anticoagulants, MAOIs, hormonal drugs	Interference
Basil	Insulin, DiaBeta, glyburide, glucotrol, glipizide	Decrease in insulin level
Black mustard (seed and oil)	Sucralfate, H_2-antagonists, PPI's	Increase in stomach acid, leading to a decrease in the efficacy of antacids
Black and white pepper	Dilantin	Elevation of plasma dilantin level
	Propranolol	Increase in absorption and plasma level of propranolol
	Theophylline	Increase in serum level of theophylline
Capsicum pepper	ACE Inhibitors	Increase in risk of cough

Appendix III (Continued)

Herb	Interacting Drugs	Consequences of Interactions
Capsicum pepper (Continued)	Antacids	Increase in acidity leading to a decrease in the performance of antacids
	Aspirin	Increase in gastric mucosal damage from ASA
	Barbiturates	Increase in sedative effects and adverse effects
	Cocaine	Enhancement of the effects of cocaine, and increase in the risk of side effects
	Theophylline	Increase in absorption
Cinnamon bark	Acid-inhibiting drugs	Interference with the drugs by increasing stomach acid
Clove	Anticoagulant drugs	Potentiation of the effects of anticoagulant drugs
Cumin	Barbiturates	A possible decrease or increase in activity
	Diabetes therapy	Increase in hyperglycemia
Eucalyptus	Hypoglycemic drugs	Interference with glucose levels

Appendix III (Continued)

Herb	Interacting Drugs	Consequences of Interactions
Eucalyptus (continued)	Hepatically metabolized drugs	Induction of liver enzymes, leading to reduction of the activity of drugs
Fennel	Ciprofloxacin	Decrease in effectiveness of the antibiotic
Fenugreek	Corticosteroids	Decreased anti-inflammatory effect
	Warfarin	Increased anticoagulation
Flax	Laxatives	Potentiation of laxative effect
	Many oral medications	Impairment of oral absorption
Garlic	Saquinivar	Decreased saquinivar levels -decreased antiviral effect
Ginger	Warfarin	Increase in risk of bleeding
Indian long pepper	Dilantin	Increase in dilantin levels
	Propranolol	Enhancement in antihypertensive activity
Jimson weed	Anticholinergic drugs	Increase in anticholinergic effects and adverse effects
Khat	Amoxicillin, ampicillin	Decrease in absorption; diminished antibiotic effect

Appendix III (Continued)

Herb	Interacting Drugs	Consequences of Interactions
Lime oil	Psoralens	Potentiation of effects and adverse effects of psoralens
Lemon juice	Felodipine	Increased felodipine levels and adverse effects
Lemon	Chloroquine	Decreased plasma levels-decreased antimalarial effect
Myrrh	Diabetes therapy	Interference in therapy
Nutmeg and mace	MAOIs	Increase in MAOIs
	Phenobarbital	Decrease in the activity of phenobarbital
Marijuana	Barbiturates	Decrease in clearance of barbiturates
	Fluoxetine, disulfiram	Transient hypomanic episodes
	Theophylline	Increase in the metabolism of theophylline
Olive oil	Antihypertensive drugs	Enhanced blood pressure lowering
Onion	Antidiabetic drugs	Enhancement of antidiabetic effects and change in blood sugar control

Appendix III (Continued)

Herb	Interacting Drugs	Consequences of Interactions
Onion (Continued)	Antiplatelet drugs	Increase in risk of bleeding
	Aspirin	Possible enhancement of allergy to onion
Pennyroyal	Cytochrome P-450 metabolized drugs	Effect on other drugs metabolized in the same pathway
Peppermint oil	Felodipine	Increase in felodipine levels, leading to increased effects and side-effects
	Simvastatin	Increase in simvastatin levels
Plantain	Lithium	Possible reduction in plasma level of lithium
Pomegranate	Oral drugs	Impaired absorption due to high tannin content of pomegranate
Pumpkin	Warfarin	Increase in INR; increased risk of bleeding
Rue	PUVA therapy	Increase in phototoxic response
Safflower	Anticoagulants	Increase in anticoagulant effect and adverse effects

Appendix III (Continued)

Herb	Interacting Drugs	Consequences of Interactions
Tamarind	Aspirin	Increase in the bioavailability of aspirin
	Chloroquine	Decrease in chloroquine plasma levels
Turmeric	Antiplatelet drugs	Increase in anti-platelet effects and adverse effects
	Non-steroidal anti-inflammatory drugs (NSAID's)	Increased risk of bleeding and increase in GI irritation
	Reserpine and indomethacin	Reduction in the risk of reserpine and indomethacin-induced duodenal ulcers
Verbena	Doxycycline	Enhanced response to therapy of bacterial sinusitis, using verbena, doxycycline, and topical decongestants
	Hormone therapy	Interference with hormone therapy from excessive amounts of verbena
	Hypertensive/ hypotensive drugs	Interference with both activities with the use of excessive amounts of verbena
	Levodopa	Enhanced anti-tremor effect

Appendix IV

Metabolizing P450 enzymes, and the corresponding major substrate metabolites*,+

CYP1A2		
Alosteron	Estrone	Rifbutin
Aminophylline	Estropipate	Riluzole
Betaxolol	Flutamide	Roprinole
Caffeine	Fluvoxamine	Tacrine
Clomipramine	Guanabenz	Theophylline
Doxepin	Mexiletene	Thiothixene
Duloxetine	Mirtazepine	Trifluperazine
Estradiol	Prinzide	
Estrogens	Propranolol	

CYP2A6
Dexamendotolimine
Rifampin

CYP2B6		
Bupropion	Irbesatran	Promethazine
Cyclophosphamide	Irinotecan	Propofol
Etavirenz	Keatamine	Selegeline

CYP2C8/9		
Amiodarone	Glipizide	Neteglinide
Bosentan	Ketamine	Paclitaxel
Carvediol	Losartan	Phenytoin
Fluoxetine	Mephenytoin	Pioglitazone
Fosphenytoin	Mestranol	Propofol
Glimepride	Montelukast	

Appendix IV (Continued)

CYP2C8/9 (continued)		
Repaglinide	Sulfipyrazone	Trimethoprim
Rifampin	Sulfisoxazole	Voriconazole
Rosiglitazone	Tacrolimus	Warfarin
Selgeline	Trotropium	Zafirlukast
Sufentanil	Torsemide	Zoplicone

CYP2C19		
Carisprodol	Fosphenytoin	Omeprazole
Clarithromycin	Imipramine	Pantaprazole
Clobazam	Lansoprazole	Penatamidine
Clofibrate	Mephenytoin	Phenobarbital
Clomipramine	Mephobarbital	Phenytoin
Desogestrel	Methylergonovine	Progesterone
Diazepam	Moclobemide	Rapeprazole
Escitalopram	Nefanavir	Sertraline
Esomeprazole	Nilutamide	

CYP2D6		
Amitryptiline	Despiramine	Hydrocortisone
Amoxapine	Dextroamphetamine	Imiquimod
Aripiprazole	Dihydrocodone	Labetalol
Atomoxetine	Doxepine	Lomustine
Betaxolol	Doxorubucin	Medroxyprogestrone
Captopril	Duloxetine	Methamphetamine
Carvediol	Flecamide	Methylphenidate
Chloroquine	Flouxetine	Mexeletine
Chlorpromazine	Fluphenazine	Miconazole
Clomipramine	Formoterol	Moclobemide
Codeine	Haloperidol	

Appendix IV (Continued)

CYP2D6 (continued)

Modafinil	Pipotiazine	Timolol
Nefazodone	Procainamide	Tolterodine
Nortryptiline	Promethazine	Tramadol
Paclitaxel	Propranolol	Troleandomycin
Paroxetine	Protiptyline	Venflaxine
Perphenazine	Riluzone	Zulcopenthixol
Phencyclidine	Sertraline	
Pindolone	Tamoxifen	

CYP2E1

Chlorzoxazone	Halothane	Sertraline
Dacarbazine	Isoflurane	Theophylline
Enflurane	Isoniazid	Trimetholone

CYP3A4

Albuterol	Budesonide	Dantrolene
Alfentanil	Buprenorphine	Dapsone
Alprazolam	Busulfan	Delavidrine
Amiodarone	Carbamazepine	Diazepam
Amlodipine	Carivastain	Digitoxin
Amprinavir	Chlordiazepoxide	Dihdroergotaime
Aprepitant	Chloroquine	Diltiazem
Aripiprazole	Chlorpheniramine	Disopyramide
Atazenavir	Clostazol	Docetaxel
Atomoxetine	Cisapride	Doxorubucin
Azithromycin	Clarithromycin	Doxycycline
Bezafibrate	Clobazam	Drospirenone
Bortezomib	Clorazepate	Enflurane
Bosentan	Cocaine	Eplerenone
Bromazepam	Cyclophosphamide	Ergolide mesylates
Bromocrptine	Cyclosporine	Ergonovine

Appendix IV (Continued)

CYP3A4 (continued)

Ergotamine	Medroxyprogestrone	Rifabutin
Erythromycin	Mefloquine	Rifampin
Escitalopram	Meloxicam	Ritonavir
Estrogen	Methylergonovine	Saquinavir
Estrone	Miconazole	Sidenafil
Estropipate	Midazolam	Simvastatin
Ethinyl estardiol	Miglustat	Sirolimus
Ethosuximide	Mirtazapine	Spiramycin
Etoposide	Modafanil	Sufetnanil
Exematane	Mometasone furoate	Tacrolimus
Felbamate	Moricizine	Tamoxifen
Felodipine	Nateglinide	Telithromycin
Fentanyl	Nevirapine	Tetracycline
Flurazepam	Nicardipine	Theophylline
Flutamide	Nifedipine	Tiagabine
Fluticasone	Nimodipine	Ticlodipine
Gefitinib	Nitrendipine	Tolterodine
Halofantrine	Norethindrone	Toremifene
Haloperidol	Nogestrel	Trazodone
Indomethacin	Ondasteron	Triazolam
Irinotecan	Paclitaxel	Trimethoprim
Isosorbide MN	Pergolide	Trimipramine
Isosorbide DN	Phencylidine	Troleandomycin
Isradipine	Pinozide	Vardenafil
Itraconazole	Rosiglitazone	Venflaxine
Ketamine	Pipotazine	Verapamil
Ketoconazole	Primaquine	Vinblastine
Letrozole	Progesterone	Vincristine
Levonoergestrol	Quetiapiene	Vinolerbine
Lidocaine	Quinidine	Zolpidem
Losartan	Rabeprazole	
Lovastatin	Repaglinide	

Appendix IV (Continued)

CYP3A4 (continued)	
Zolanamide	Zoplicone

*Adapted from:

Lacy HC, Armstrong LL, Goldman MP, Lance LL. Drug Information Handbook. 13th edition. Hudson, OH: Lexicomp; 2005; pp 1680-1685.

+Notice that throughout the text, some herbs have been mentioned to affect one or more of the above P450 enzymes, and hence may in turn affect the levels or the effectiveness of drugs metabolized by these enzymes.

Glossary

Abortifacient (Abortive): A drug or material that causes the expulsion of the fetus.

Abscess: A circumscribed collection of pus appearing in an acute or localized infection.

Acne: Chronic inflammatory disease of the skin glands characterized by papules and pustules.

Active principles (active components; active constituents): Chemicals in plants and other products that are responsible for biological or therapeutic activity.

Adipocytes: Fat cells.

Adjuvant: A substance , especially a drug, added to a prescription to assist the action of the main ingredient.

Amoebiasis: Infection with ameba (minute one-celled protozoan).

Amenorrhea: Absence or suppression of menstruation.

Analgesic: An agent that gives relief of pain.

Anemia: A decrease in hemoglobin in the blood to levels below the normal range.

Anesthetic: A drug or agent that is capable of producing a complete or partial loss of feeling (anesthesia).

Angina: A spasmodic, cramp-like chocking feeling in the chest.
Anorexia: Lack or loss of appetite, resulting in the inability to eat.
Antacids: Drugs or other agents that buffer, neutralize, or absorb hydrochloric acid in the stomach.
Anthelminthic: A drug that kills or causes destruction and expulsion of worms.
Anticholinergics: Drugs that block acetyl-choline receptors, and bu such action used to treat conditions such as spastic disorders of the GI tract, to reduce salivary secretions, dilate the pupil, etc.
Anticoagulants: Agents that prevent or delay coagulation of the blood.
Antidote: An agent that neutralizes a poison or counteracts its effects.
Antidysenteric: An agent that prevents or relieves dysentery.
Antiemetic: A drug that prevents or relieves nausea and vomiting.
Antiflatulent: An agent that removes gas from the digestive tract.
Antifungal: A substance that destroys or inhibits the growth of fungi.
Anti-inflammatory: An agent that counteracts inflammation.
Antimycotic: Antifungal.
Antineoplastic: An agent that prevents the development, maturation, and spread of neoplastic (tumorous or cancerous) cells.
Antiretroviral: An agent used against retroviruses that cause HIV/AIDS.
Antispasmodic: An agent that prevents or relieves spasm or involuntary and irregular contraction of the body muscles.
Antipyretic: An agent which treats fever.
Antiscorbutic: An agent to fight scurvy.
Aspiration: The inspiration into the airway of foreign material.
Astringent: An agent which precipitates proteins from the surface of cells or mucous membranes producing a protective covering.
Antitussive: A drug that prevents or relieves coughing.
Anxiolytic: A sedative or minor tranquilizer used to treat episodes of anxiety.
Aphrodisiac: An agent which stimulates sexual desire.
Aphthous ulcer: A white oral sore, or ulcer of unknown cause.
Arteriosclerosis (atherosclerosis): Hardening of the arteries.

Arthritis: Any inflammatory condition of the joints characterized by pain and swelling.

Ascariasis: Intestinal parasitic infection caused by a group of roundworms and thread worms.

Asthma: Difficulty in breathing.

Astringent: An agent that has a constricting or binding effect, for example, one which checks hemorrhages, secretions, etc.

Atrophy: A wasting of tissues, organs, or the entire body.

Bacteremia: The presence of bacteria in the blood.

Bell's palsy: Paralysis of the facial nerve.

Beriberi: A disease of the peripheral nerves cause by a deficiency of or inability to assimilate thiamine.

Blood stasis: A disorder in which normal flow blood through the vessels is slowed or halted.

Boils: A painful nodule formed in the skin by circumscribed inflammation of skin tissues, enclosing a central slough or core. Also called "furuncle."

Botanical remedies: Medicines obtained from plants.

Bradycardia: Slow heartbeat.

Bronchitis: Inflammation of the bronchial mucous membrane.

Bunions: An abnormal enlargement of the joint at the base of the great toe.

Bursitis: An inflammation of the bursa, the connective tissue structure surrounding a joint.

Callus: Hardened skin (thickening of circumscribed area of horny layer of the skin).

Carbuncles: A large staphylococcal infection containing purulent matter in deep, interconnecting, subcutaneous pockets.

Cardiac arrest: A sudden cessation of cardiac output and effective circulation.

Cardiomyopathy: Any disease that affects the structure and function of the heart.

Cardiotonic: A general term to indicate beneficial effects on the heart.

Carminative: An agent which releases flatulence, digestive colic, and gastric disorders.

Catalepsy: An abnormal state characterized by trance-like level of consciousness and postural rigidity. It occurs in hypnosis and in certain organic and psychologic disorders such as schizophrenia, epilepsy and hysteria.

Catarrh: Inflammation of the mucous membranes with discharge, especially inflammation of the air passages of the nose and the trachea.

Cathartic: An active purgative, producing bowel movements.

Carminative: A substance which prevents formation of, or promotes expulsion of flatus (wind generated in the stomach or bowels).

Cellulitis: Inflammation of the cellular and connective tissue.

Chemotherapeutic agents: A term usually used to refer to medications for treating cancer.

Chloasma: Pigmentary skin discoloration usually occurring in brown patches and spots.

Chlorosis: A form of iron-deficiency anemia.

Cholagogue (choloretic, cholecytagogue): An agent which increases the flow of bile into the intestine.

Cholerectic: An agent which increases the secretion of bile by the liver.

Climacteric: The cessation of the menses

Colic: Spasmodic pain affecting smooth muscles in the intestine and urinary tract.

Colitis: Inflammation of the colon (large intestine).

Congestive heart failure (CHF): An abnormal condition of the hear that reflects impaired cardiac pumping, resulting in volume overload.

Conjuctivitis: Inflammation of the conjuctiva of the eyes.

Constipation: Infrequent defecation with passage of unduly hard and dry fecal material.

Contraceptive: A drug or method that prevents conception.

Contraindication: Any symptom, circumstance or drug indicating the inappropriateness of a form of treatment otherwise advisable.

Contusion: An injury that does not disrupt the integrity of the skin,

cause by a blow to the body, characterized by swelling, discoloration, and pain.

Convalescence: A period of recovery for an illness, injury, or surgery.

Convulsion: A violent spasm or series of jerking of the face, trunk, or extremities. Seizure.

Corn: Horny induration and thickening of the skin, hard or soft, according to location.

Coronary artery disease: One of the abnormal conditions that may affect the arteries of the heart and produce various pathologic effects, especially reduced flow of oxygen and nutrients to the myocardium.

Coronary calcification: Deposition of calcium in coronary vessels.

Counterirritant: An agent that causes irritation or a mild inflammation of the skin in order to relieve deep-seated inflammatory process.

Cramp: A painful spasm.

Cystitis: Inflammation of the urinary bladder.

Cytotoxic: detrimental or destructive to the cells.

D_2-agonist: An agent such as bromocriptine which stimulates D_2 receptors, which are specific dopaminergic receptors in neurons.

Dandruff: An excessive amount of scaly material composed of dead epithelium from the scalp.

Decongestant: An agent that reduces nasal congestion.

Delirium: A state of mental confusion and excitement characterized by disorientation for time and place, usually with illusions and hallucinations.

Demulcents: Substances used for soothing and reducing irritation of surfaces that have been abraded or irritated.

Depurative: An herb that gradually stores the proper functioning of the body and increase health and vitality. A synonym for "**alterative**."

Dermatitis: Inflammation of the skin evidenced by itching, redness, and various skin lesions.

Diaphoretic: An agent that produces or promotes sweating.

Diarrhea: Frequent passage of abnormally watery bowel movements.
Digestant: An agent that will digest food or aid in digestion.
Disseminated Intravenous Coagulation (DIC): Uncontrolled clotting of blood throughout small blood vessels leading to tissue necrosis and bleeding.
Diuretic: An agent which increases the secretion of urine.
Diverticulitis: Inflammation of one or more diverticula (a pouch-like herniation in a tubular organ such as the stomach, small intestine and colon).
Dropsy: Morbid accumulation of water in the tissues and cavities.
Dysentery: Intestinal disorders characterized by inflammation of the mucous membrane.
Dyskinesia: An impairment of the ability to execute voluntary movements.
Dysmenorrhea: Painful or difficult menstruation.
Dyspepsia: Imperfect digestion caused by disease, or disorders.
Dysurea: Difficulty or pain in urination.
Eczema: Acute or chronic cutaneous inflammatory condition with erythema, papules, vesicles, pustules, scales, crusts, or scabs alone or in combination, which may be dry or wet.
Edema: The accumulation of excess fluid in a fluid compartment. Also called dropsy or hydrops
Elephantiasis: Swelling of the legs and genitalia caused by filarial worm (also called "filariasis").
Emenagogue: A substance which promotes or assists the menstrual flow.
Emetic: An agent that produces vomiting.
Emollient: A substance that softens tissue, particularly the skin and mucous membranes.
Emphysema: Breathlessness on exertion.
Encephalitis: An inflammatory condition of the brain.
Endemic: Occurring only in a certain region or country.
Enteritis: Inflammation of the mucosal lining of the small intestine.
Enuresis: Incontinence (failure to urinate) without an organic cause.
Esophagitis: Inflammation of the esophagus.
Euphoria: An exaggerated feeling of well-being.

Expectorant: A substance that facilitates the removal of secretions of the broncho-pulmonary mucous membrane.

Extract: A solid or semi-solid obtained by extracting the soluble portion of a plant material with a fluid, followed by evaporation of the solution.

Flatulence: Excessive gas in the stomach and intestines.

Furuncle: Localized infection originating in a hair follicle.

Galactogogue: An agent that increases the flow of milk from lactating woman

Gastroenteritis: Inflammation of the mucous membranes of both the stomach and intestine.

Gingivitis: Inflammation of the gums characterized by redness, swelling and tendency to bleed.

Gargle: A wash for the throat.

Gastritis: Inflammation of the stomach.

Gastroenteritis: Inflammation of the stomach and intestinal tract.

Glossitis: Inflammation of the tongue.

Goitrogenic: Producing (causing) goiter.

Gout: A metabolic disease marked by arthritis and inflammation of the joints.

Heartburn: Burning sensation in the esophagus, or below the sternum in the region of the heart.

Hemorrhage: Abnormal internal or external discharge of blood.

Hemorrhoids: Dilated blood vessels in the anal region liable to discharge blood.

Hemoptysis: Spitting of blood or blood-stained sputum.

Hemostyptic: A substance or an astringent which is often used to control bleeding.

Hepatic: An agent which affects the liver harmfully or correctively.

Hepatitis: Inflammation of the liver of virus or toxic origin.

Hepatocarcinoma: Malignant hepatoma (cancer or neoplasm of the liver).

Hernia: Protrusion of a part or structure of the body through tissues normally containing it.

Hiatal hernia: Protrusion of a part of the stomach through the esophageal hiatus (opening) of the diaphragm.

Hydrophilic: Showing affinity to water molecules.
Hypercalcemia: Excess of calcium in the blood.
Hypercholesterolemia: Elevated cholesterol level in the blood.
Hyperthermia: Unusually high fever.
Hypoglycemia: Abnormally low concentration of glucose in the blood.
Hypokalemia: Lower than normal amount of potassium in the blood.
Hypomanic episodes: Manifestation of a mild degree of mania characterized by optimism, excitability, energetic, productive behavior, marked hyperactivity, etc.
Hypotension: Low blood pressure.
Hypothrombinemic effect: conditions causing deficiency of the clotting factor thrombin in the blood.
Illicit drugs: Unlawful or otherwise not permitted substances.
Immunosuppressant: A substance that decreases or prevents immune response.
Impotence: Weakness, especially inability of the male to achieve or maintain erection.
Indication: A sign or circumstance which indicated the proper treatment of a disease.
Inflammation: A pathologic process involving cells and blood vessels in response to injury or abnormal stimulation caused by a physical, chemical or biological agent.
Infusion: A product obtained by steeping a substance in hot or cold water in order to obtain its active principles.
Inhalation: A product inhaled into the respiratory tract by breathing in.
Inotropic effect: Increase in the force of muscular contraction of the heart.
Insomnia: Chronic inability to sleep, or sleep interrupted by periods of wakefulness.
International Normalized Ration (INR): A measure of how fast the blood clots.
Irritable bowel syndrome: A motility disorder involving the entire gastrointestinal tract (GI), causing abdominal pain, constipation and/or diarrhea and abdominal bloating.

Jaundice: A yellow discoloration of the skin, mucous membranes, and sclera of the eyes cause by greater than normal amounts of bilirubin in the blood.

Laryngitis: Inflammation of the mucous membrane of the larynx.

Larvicide: An agent that kills insect larvae.

Laxative: An agent that acts to loosen the bowels by facilitating the passage of bowel contents at the time of defecation, and, therefore to prevent or treat constipation.

Leishmaniasis: Infection affecting the skin, nasal cavities and the pharynx.

Leprosy: An infectious disease resulting from the invasion of nerves by *Mycobacterium leprae.*

Lethargy: A state of deep and prolonged unconsciousness resembling profound slumber from which one can be aroused.

Libido: Sexual drive, conscious or unconscious.

Liniment: A liquid preparation for external application or application to the gums.

Lumbago: Pain in the mid and lower back (lumbar rheumatism).

Lupus nephritis:

Lymphadenitis: An inflammatory condition of the lymph nodes, usually the result of a systemic neoplastic disease, bacterial infection, or other inflammatory conditions.

Mastectomy: Surgical removal of one or both breasts.

Measles: A highly communicable disease characterized by fever, general malaise, sneezing, nasal congestion, brassy cough, conjunctivitis, spots on the buccal mucosa, and a maculopapular eruption over the entire body caused by rubeola virus.

Menopause: Permanent cessation of menses.

Menorrhagia: Excessive bleeding at the time of menstrual period.

Menses: Menstruation.

Micturation: Urination

Monoamine Oxidase Inhibitor (MAOI): Any of a chemically heterogenous group of drugs used primarily in the treatment of depression.

Monograph: A treatise dealing with a single subject.

Mucilage: A natural plant hydrocolloid which is usually translucent, heterogenous and amorphous; forms a slimy mass with water.

Mucosa: Mucous membrane, such as that lining the mouth, etc.

Multiple sclerosis (MS): A progressive disease characterized by disseminated demylination (destruction of the cover) of nerve fibers in the brain ans spinal cord

Mumps: A contagious disease characterized by inflammation of the parotid glands and other salivary glands.

Myalgia: Muscular pain.

Myelosuppression: The inhibition of the process of the production of blood cells and platelets in the bone narrow.

Nephropathy: Any disorder of the kidney, including degenerative and sclerotic conditions.

Neuralgia: Severe sharp pain along the course of a nerve.

Otitis: Inflamed condition of the ear.

Oxytocic: An agent which stimulates uterine contraction during child birth.

Palpitations: Rapid, violent, or throbbing pulsation, as abnormally rapid throbbing or fluttering of the heart.

Paresthesias: Any subjective sensation, experienced as numbness, tingling, or "pins and needles" feeling.

Peptic ulcer: A sharply circumscribed loss of mucous membrane of the stomach, duodenum, or any other part of the gastrointestinal system exposed to gastric juices containing acid and pepsin.

Pharmacological test: Test conducted to study the effect of a medicinal agent.

Photodermatitis: Sensitivity of the epithelium of the skin to light.

Phototoxic: Producing a condition as a result of being overexposed to light in combination with certain substances.

Physiological: Concerning body functions.

Phytochemical: Chemicals or pertaining to chemicals that are found in plants.

Phytotherapy: Treatment using medicinal plants.

Pleural effusion: Escape of fluid from the pleural cavity into the surrounding tissue.

Pimple: A papule (small circumscribed, superficial elevation of the skin) or a pustule (pus-containing small circumscribed elevated lesion of the skin).

Pluerisy: Inflammation of the pleura (the serous membrane enveloping the lungs and the lining of the walls of the pleural cavity.

Pneumonia: Inflammation of the lung caused by infection by bacteria, viruses, other organisms, or inhalation of some chemicals.

Polyuria: Excretion of abnormal large quantity of urine.

Pomade: A perfumed ointment often used on the head.

Post-prandial: Pertaining to after meals.

Psoriasis: Chronic, recurrent skin disease marked by discreet bright red macules, papules or patches covered with silvery scales.

Potency: Strength.

Poultices: A soft, moist mass of plant parts that are wrapped in muslin or gauze and applied warm or hot to the skin.

Pruritis: The symptom of itching, an uncomfortable sensation leading to the urge to scratch.

Purgative: An agent that causes watery evacuation of the intestinal contents.

PUVA Therapy: A treatment involving a photosensitizing psoralen that reacts with ultraviolet light to increase melanin in the skin.

QT prolongation: An abnormal electrocardiogram showing long Q-T interval associated with life-threatening ventricular tachycardia known as torsade de pointes.

Rabies: An acute viral infection mainly of the central nervous system transmitted to man by the bite of a rabid dog, cat, jackal, or bat.

Rectal prolapse: Dropping the rectum.

Resin: An acidic substance that is either a phenolic derivative or an oxidation product of terpenes; usually a solid or semisolid material of complex chemical nature.

Rheumatism: A general term for acute and chronic conditions characterized by inflammation, soreness and stiffness of

muscles, and pain in joints and associated structures.

Rhinorrhea: A discharge from the nasal mucous membrane.

Rhizome: An elongated, usually horizontal underground stem bearing buds in the axils of reduced scale-leaves.

Ringworm: A common contagious disease produced by fungi that affects the skin, hair, or nails.

Scabies: A contagious parasitic disease of the skin caused by the mite *Sarcoptes scabies*.

Sciatica: Neuralgic pain along the course of the sciatic nerve caused by inflammation injury to the nerve.

Scurvy: A disease marked by debility, anemia, ulceration, and hemorrhages caused by vitamin C deficiency.

Seasickness: Nausea and vomiting caused by the rolling and pitching of a vessel at sea.

Seizures: Convulsion; an epileptic attack.

Sensitization: A condition of being made sensitive to a specific substance.

Sprain: An injury to a ligament when the joint is carried through a range of motion greater than normal.

Steam distillation: Distillation which uses steam to isolate various plant compounds.

Shingles: Also known as herpes zoster, an acute infection caused by te reactivation of the latent varicella zoster virus (VZV).

Steep: To soak in hot water.

Stomachic: A medicine which stimulates stomach secretions.

Stomatitis: Inflammation of the mouth.

Stroke: Sudden neurological condition due to impaired blood flow in the brain.

Synergism: A process by which one drug enhances the function and effect of another drug when administered simultaneously.

Syphilis: An infectious, chronic, venereal disease characterized by lesions which may involve any organ or tissue.

T_3 (thyroxine) and T_4 (thyronine): Iodine-containing compounds from the thyroid gland, whose levels are affected by various disease states.

Tachycardia: Rapid beating of the heart.

Tachynea: An abnormally rapid rate of breathing.

Tachyphylaxis: A pharmacological phenomenon in which repeated administration of a drug results in a marked change in effectiveness.

Taeniacide: An agent that kills tapeworms.

Taeniafuge: An agent that expels tapeworms.

Tetanus: An acute, potentially fatal infection of the central nervous system caused by toxins released by *Clostridium tetani.*

Tetany: A condition characterized by cramps, convulsions, twitching of the muscles, and sharp flexion of the wrist and the ankle joints.

Thyroid storm: Also known as thyrotoxic crisis, a result of high levels of thyroid hormone, is a sudden exacerbation of the signs and symptoms of thyrotoxocosis, presenting as a life-threatening syndrome.

Tinea corporis: A superficial fungal infection of the non-hairy skin of the body.

Tinea cruris: A superficial fungal infection of the groin.

Tinea pedis: A superficial fungal infection of the foot, especially between the toes and on the soles.

Tincture: Hydroalcoholic solution in which 10 ml contains the active constituents found in 1 to 2 g of the herb.

Tonic: An agent which strengthens and enlivens a specific organ or the whole body.

Tonsilitis: Inflammation of a tonsil.

Torsade de pointes: A change in the electrical activity (electrocardiogram) of the heart as a result of ventricular tachycardia (fast contraction of the lower chambers of the heart), which is usually drug-induced.

Toxin: A noxious or poisonous substance that is formed or elaborated by the body.

Trismus: A prolonged tonic spasm of the muscles of the jaw.

Typhus: Any of a group of acute infectious diseases characterized by great prostration, severe headache, generalized maculopapular rash, sustained high fever, and usually progressive neurologic involvement, ending in a crisis in 10 to 14 days.

Tumor: A swelling or enlargement occurring in inflammatory condition; also called neoplasm.

Urinary retention: Failure or inability to empty the bladder.

Urticaria: A pruritic skin eruption characterized by transient wheals of varying shapes and sizes with well defined erythematous margins and pale centers.

Uterine prolapse: A dropping of the uterus.

Varicose veins: Permanent dilation of the veins commonly seen in the legs.

Vasodilator: An agent that dilates blood vessels, usually used in the treatment of high blood pressure.

Vermifuge: An agent that expels intestinal worms.

Virustatic: Pertaining to the inhibition of the growth and development of viruses.

Vitiligo: Skin condition characterized by milk-white patches, surrounded by areas of normal pigmentation

Warts: A circumscribed cutaneous elevation resulting from hypertrophy of the epidermis.

Whooping cough (pertussis): An active inflammation of the larynx, trachea, and bronchi caused by *Bordetella pertussis*.

Index

A

Abish, *vi, 69*
Abortifacient, *42, 83, 100, 116, 118, 149*
Abyssinian tea, *88*
Accachilt, *63*
ACE inhibitors, *66, 137*
Acetaminophen, *49, 50, 74, 75*
Addis Ababa, *iii, ix, 16, 21-23, 28-30, 35, 41, 43, 54, 64, 67, 73,87,90,97,103,110, 111, 113, 117, 119, 126*
Adjuban, *39*
Adverse reactions, *1, 17*
Aerosol inhalation, *64*
African chilies, *49*
African coffee tree, *53*
African traditional medicine, *29, 41, 54, 73, 87, 97, 103, 110, 117, 119, 126*
Afrinj, *44*
Agol, *127*
Ajenuz, *47*
Ajoene, *75, 77*
Akkoragag, *125*
Alcoholic beverages, *36, 66*
Alcoholism, *39, 49*
Allium, *74, 104*
Allium sativum, *74*
Aloe, *15, 33, 34, 131*

Amantadine, *86*
Ambasha, *61*
Amenorrhea, *33, 118, 122, 149*
Aminopyrine, *44, 58, 64, 83*
Amoebic dysentery, *42, 72*
Amoxicillin, *88-90, 139*
Amphotericin B, *122*
Ampicillin, *1, 88, 90, 139*
Andropogon citratus, *93*
Anemia, *125, 127, 149, 152, 160*
Anesthetic, *33, 57, 149*
Anethole, *37, 133-135*
Anethum graveolens, *36, 66*
Angel tulip, *86*
Angina, *93, 104, 125, 150*
Anise, *v, 36, 37, 133-135, 137*
Anise seed, *36, 37, 133-135*
Anorexia, *34, 79, 95, 150*
Antacids, *42, 55, 79, 137, 138, 150*
Anthelminthic, *53, 55, 93, 104, 112, 150*
Antiarrythmic drugs, *33, 137*
Anticoagulants, *37, 40, 42, 47, 50, 51, 57, 61, 62, 72, 77, 79, 80, 100, 118, 122, 123, 126, 137, 141, 150*
Antihistamines, *95*
Antihypertensives, *48, 50, 66, 80, 89*
Antiplatelet agents, *51, 118, 123*
Antipyretic, *33, 63, 102, 106, 150*
Apiaceae, *36, 59, 61, 66*
Aray, *33*
Arret, *33*
Arthritis, *33, 42, 74, 79, 102, 116, 125, 127, 151, 155*
Ascariasis, *33, 99, 112, 116, 151*
Ashawagandha, *132*
Aspirin, *8, 40, 50, 58, 75, 80, 83, 105, 120, 138, 141, 142*
Astenagir, *vi, 86*
Asteraceae, *118*
Asthma, *33, 47, 63, 74, 83, 86, 93, 104, 125, 151*
Astringent, *83, 89, 112, 150, 151, 155*
Atacuronium, *80*
Atherosclerosis, *49, 69, 72, 74, 93, 104, 116, 118, 150*
Ati, *53*
Attuch, *vi, 125*
AUC, *3, 4, 67, 69, 76, 91, 107, 109*
Awaze, *39, 57*

B

Back pain, *74*
Bacterial sinusitis, 126, 142
Bahr zaf, *vi, 63*
Balambi, *53*
Barbiturates, *51, 61, 62, 95, 96, 127, 132, 138, 140*
Barraka, *47*
Basil, *v, 39, 40, 130, 137*
Bastard balm, *125*
Batavia cassia, *55*
Batavia cinnamon, 55
Belladonna alkaloids, *86*
Benzodiazepines, *7, 11, 127*
Berbere, *vi, 44, 49, 104*
Beriberi, *69, 83, 151*
Besobila, *v, 39*
Bhang, *95*
Bird's foot, *69*
Black and white pepper, *vi, 44, 45*
Black caraway, *47*
Black cumin, *47*
Black Lion Hospital, *22, 23*
Black mint, *106*
Black mustard, v, 42
Black pepper, 44, 45, 129, 131-134
Black psyllium, *109*
Black seed, *vi, 47, 48*
Blanc poivre, *44*
Bleeding, *13, 33, 34, 36, 37, 40, 47, 48, 50, 51, 57, 58, 61, 63, 72, 76, 77, 79, 80, 100, 104, 114, 118-120, 122, 123, 139, 141, 142, 154, 155, 157*
Blond plantago, *109*
Blue gum, *63*
Blue vervain, *125*
Bohot, *114*
Brassica nigra, *42*
Brassicaceae, 42
Bromocriptine, *40, 89, 153*
Bronchitis, *36, 44, 47, 66, 79, 83, 86, 93, 99, 104, 109, 127, 151*
Bsha shinkurt, *104*
Bukeh, *114*
Burn plant, *33*
Burns, *63, 79, 86, 93, 102, 104, 125*
Bursitis, *33, 151*

Bushman's tea, *88*

C

C. frutescens, *49, 131*
C. odorum, *61*
Calcium, *67, 80, 103, 107, 110, 153, 156*
Camphor of the Poor, *74*
Cancer, *iii, 8, 44, 63, 72, 74-76, 80, 95, 97, 102, 116, 122, 152, 155*
Cannabinaceae, *95*
Cannabis, *xiv, 95-97*
Cannabis sativa, *xiv, 95*
Capsaicin, *13, 44, 49-51, 84, 133*
Capsicum annum, *49*
Capsicum peppers, *vi, 49*
Captopril, *50, 144*
Carafu, *55*
Carbuncles, *53, 151*
Cardiac glycosides, *33, 72, 110, 137*
Carminative, *69, 151, 152*
Caryophyllus, *57*
Castor, *vi, 53, 54, 132*
Catecholamines, *7, 37, 50*
Catha, *xiv, 88*
Catha edulis, *xiv, 88*
Cathinone, *89*
Caucasians, *6, 25, 26, 30*
Cellulitis, *152*
Chaqma, *53*
Charas, *95*
Charnushka, *47*
Chat, *vi, 88, 89*
Chemotherapeutic drugs, *80*
Chest pain, *118, 127*
Chiko, *44, 57*
Chloroquine, *91, 120, 140, 142, 144, 146*
Cilantro, *59*
Cimetidine, *106*
Cinnamon bark, *55, 131*
Ciprofloxacin, *4, 67, 139*
Cisplatin, *48, 80, 96*
Citrus limetta, *91*
Citrus limon, *91*
Ciut, *88*

Clopidogrel, *75*
Clous de girolfe, *57*
Clove, *vi, 57, 58, 132-134, 138*
Codo, *99*
Coffee, *53, 57, 116*
Colic, *47, 49, 59, 66, 74, 79, 151, 152*
Comhino negro, *47*
Common basil, *39*
Common cold, *36, 42, 55, 63, 74, 88, 93, 102, 106, 109, 116*
Common rue, *116*
Common verbena, *125*
Common vervain, *125*
Compositae, *118*
Congestive heart failure, *39, 152*
Conjuctivitis, *47, 152*
Constipation, *39, 42, 47, 69, 72, 96, 120, 152, 157*
Conventional drugs, *v, xi-xiii, 7, 9-13, 17, 19, 26, 27, 31, 35, 81, 90, 111, 123*
Copper, *67*
Coriander, *vi, 47, 59*
Corticosteroids, *34, 53, 139*
Coughs, *63, 72, 118*
Countryman's treacle, *116*
Cow's horn, *69*
Cramps, *34, 39, 49, 106, 116, 161*
Crefte, *55*
Cruciferae, *42*
Crucifers, *133-135*
Cucurbita, *114*
Cucurbita pepo, *114*
Cucurbitaceae, *114*
Cumin, *vi, 36, 47, 61, 62, 131, 138*
Cuminum cyminum, *36, 61*
Curcuma, *122*
Curcuma longa, *122*
Curcumin, *122, 123, 133, 135*
Cytochrome P450, *5, 13, 25, 30, 44, 50, 75, 84, 100, 133*

D

Dacarbazine, *96, 145*
Dandruff, *95, 153*
Datura, *86*
Datura stramonium, *86*
Debao, *59*

Dehn, *116*
Demulcents, *153*
Depression, *7, 33, 39, 48, 88, 93, 125,* 158
Devil's apple, *86*
Devil's medicine, *125*
Devil's trumpet, *86*
Diabetes, *15, 33, 61, 63, 72, 74, 93, 102, 104, 138, 140*
Diabetes therapy, *61, 138, 140*
Diallyl sulfone, *13*
Diarrhea, *34, 47, 49, 59, 61, 72, 74, 83, 96, 99, 100, 102, 112, 116, 120, 122, 154, 157*
Dietary supplements, *10-12, 17*
Digoxin, *7, 33, 34, 54*
Dilantin, *45, 84, 137, 139*
Dingetegna, *22*
Dipyridamole, *75*
Disulfiram, *140*
Diuresis, *66*
Doxorubucin, *123, 145, 146*
Droperidol, *54*
Drug interactions, *v, ix, xi-xv, 1, 2, 12-18, 21, 24-26, 28, 31, 33, 35, 36, 39, 42-44, 46, 47, 49, 51, 53-55, 57-59, 61, 63, 65, 66, 69, 71-74, 78, 79, 81-83, 85, 86, 88, 91-93, 95, 97, 99, 100, 102, 104, 106, 108, 109, 111, 112, 114, 117, 118, 120-122, 124, 125, 127, 128, 131, 135, 137*
Duba, *vi, 114*
Dysentery, *42, 47, 66, 72, 83, 99, 112, 120, 125, 150, 154*
Dyspepsia, *36, 59, 79, 104, 116, 122, 154*

E

Earache, *74*
Eczema, *69, 86, 125, 154*
Elephantiasis, *125, 154*
Elephant's Gall, *33*
Emollient, *53, 72, 154*
Emphysema, *47, 154*
Encephalitis, *102, 154*
Enoxaparin, *75*
Ensilal, *v, vi, 36, 61, 66*
Epilepsy, *83, 95, 116, 152*
Eret, *v, 33*
Esrar, *95*
Ethinyl estradiol, *145*

Ethiopian traditional medicine, *xiii, xv, 22, 24, 29, 35, 43, 64, 67, 97, 99, 113, 119, 126*
Ethnobotany, *22, 48, 81, 86, 128*
Etse mengist, *125*
Eucalypti folium, *63*
Eucalyptol, *64, 133*
Eucalyptus globulus, *63*
Eucalyptus oil, *64*
Eucalyptusblatter, *63*
Eugenol, *39, 57, 133, 134*
Euphorbiaceae, *53*
Evil eyes, *127*
Expectorant, *36, 57, 63, 118, 155*
Eye diseases, *74, 88*

F

F. officinale, *66*
Fabaceae, *69, 120*
Faux aneth, *61*
Faux anis, *61*
Felodipine, *107, 108, 140, 141, 145*
Fennel, *vi, 47, 66, 67, 133, 134, 139*
Fennel flower, *47*
Fentanyl, *80, 145*
Fenugreek, *vi, 69, 70, 131, 132, 139*
Ferenja tumwa, *104*
Fever tree, *63*
Fevers, *22, 36, 49, 125*
Finnochio, *66*
Fitch, *47*
Flatulence, *42, 57, 66, 79, 100, 102, 104, 106, 122, 151, 155*
Flax, *vi, 72, 73, 131, 139*
Flaxseed, *72, 73*
Flea seed, *109*
Florence fennel, *66*
Flores caryophyllum, *57*
Fluconazole, *6, 123*
Flumazenil, *7*
5-Fluorouracil, *123*
Fluoxetine, *6, 12, 96, 140, 143, 145*
Foeniculum vulgare, *36, 66*
Foenugreek, *69*
Furuncles, *93, 104*

G

Ganja, *95*
Garden basil, *39*
Garden fennel, *66*
Garden rue, *116*
Garlic, *vi, 13, 74-77, 129, 131-134, 139*
Gastritis, *72, 74, 106, 155*
Gen Pi, *112*
German rue, *116*
Gewz, *vi, 100*
Ginger, *vi, 13, 79-81, 131, 132, 139*
Gizawa, *vi, 127*
Glibenclamide, *34, 69*
Glipizide, *39, 137, 144*
Glucotrol, *137*
Glyburide, *34, 39, 69, 137*
Goat's horn, *69*
Gofa, *88*
Golqwa, *53*
Gommit, *49, 125*
Gondar, *23, 96*
Gonorrhea, *63, 66, 88, 102*
Gorteb, *vi, 109*
Gout, *69, 125, 155*
Grains of Paradise, 49
Graminae, *93*
Grandada, *112*
Grass, *93, 95, 125*
Greek hay, *69*
Green pepper paste, *39, 74*
Grenadier, *112*
Guanethidine, *89*
Guatemala lemongrass, *93*
Guli, *53*
Gulla, *116*
Gum tree, *63*

H

H_2-antagonists, *42, 55*
Hallucination, *86*
Hamham, *114*
Harar, *96*
Hash, *95*

Hashish, 95
Headache, *22, 39, 47, 66, 74, 83, 95, 101, 102, 104, 106, 116, 162*
Heart disease, *33, 49, 74, 118, 125*
Hemorrhoids, *33, 47, 53, 74, 95, 102, 112, 120, 155*
Herb of the Cross, *125*
Herbygrass, *116*
Herb-of-Grace, *116*
Hexobarbital, *45, 50, 133*
Hidi budawa, *127*
Holywort, *125*
Homar, *vi, 120*
Home remedies, *23*
Hormone replacement therapy, *37, 72*
Hsiang-Dan, *33*
Hulbata, 69
Hydrochlorothiazide, *11, 103*
Hydrocortisone acetate, *34*
Hypnotics, *95*
Hypoglycemic agents, *37, 40, 48, 51, 59, 61, 70, 72, 76, 77, 80, 99, 103, 123, 128*
Hypokalemia, *34, 53, 54, 156*
Hysteria, *116, 125, 152*

I

Illicit drugs, *156*
Imlee, *120*
Incontinence, *66, 154*
Indian hyssop, *125*
Indian long pepper, *vi, 83*
Indian saffron, *122*
Indigestion, *42, 66, 83, 125*
Indomethacin, *11, 40, 45, 75, 77, 80, 84, 123, 142*
Indoramin, *89*
Influenza, *55, 86, 116*
INR, *77, 81, 107, 114, 141, 156*
Insomnia, *83, 100, 101, 156*
Insulin, *37, 39, 40, 48, 51, 59, 61, 64, 69, 70, 72, 73, 76, 77, 80, 99, 103, 105, 123, 128, 131, 137*
Intelligence booster, *95*
Irgo, *116*
Iron, *37, 67, 107, 110, 112, 126, 152*
Isothiocyanates, *13, 133*
Isozymes, *5, 6, 13, 14, 24, 25, 44, 84, 129, 130, 133*

J

Jamestown weed, *86*
Jaundice, *23, 102, 122, 125, 157*
Jimma, *23, 29, 88*
Jimma Hospital, *23, 29*
Jimson weed, *vi, 86, 139*
Juno's tears, *125*

K

Kamun, *61, 66*
Kamuna, *61*
Kamun-bahari, *61*
Katikala, *66*
Kefo, *39*
Keshertana, *104*
Khat, *vi, xv, 88-90, 139*
Kobo, *53*
Koladeba, *23*
Kontar, *72*
Kosho, *44*
Kura wesfe, *109*
Kusel-salahin, *88*
Kuti, *116*

L

Labiatae, *39, 106*
Lamb mint, *106*
Lamiaceae, *39*
Large fennel, *66*
Laryngitis, *49, 157*
Lauraceae, *55*
Laxatives, *10, 53, 54, 73, 117, 120, 132, 139*
Leguminosae, *69, 120*
Lemon, *vi, 49, 91-93, 140*
Lemon juice, *140*
Lemongrass, *vi, 93, 129*
Leprosy, *53, 69, 83, 95, 122, 157*
Levodopa, *126, 142*
Levomethadyl, *54*
Libido, *36, 157*
Liliaceae, *33, 74, 104*
Lily of the Desert, *33*

Limon, *91*
Lina, *72*
Linaceae, *72*
Lincomycin, *4*
Linseed, *72*
Lint bells, *72*
Linum, *72*
Linum usitatissimum, *72*
Lipid-lowering drugs, *70*
Lithium, *110, 141*
Liver disease, *125*
Locoweed, *86*
Lomi, *vi, 91*
Long pepper, *vi, 83, 84, 129, 131-134*
Loss of appetite, *36, 59, 63, 69, 79, 93, 95, 104, 106, 116, 122, 150*
Low molecular weight heparins, *37, 51, 57, 118, 123*
Lucca, *102*
Lumbago, *42, 157*
Lu-Hui, *33*

M

M. aquatica, *106*
Mace, *100, 140*
Macis, *100*
Mad-apple, *86*
Mariguana, *95*
Marihuana, *95*
Marijuana, *vi, xiv, 95-97, 140*
Mbalcha, *53*
Melancholia, *125*
Meningitis, *63, 102*
Mental illnesses, *53, 74*
Mentha x piperita, 106
Menthol, *106, 107*
Merare, *33*
Meta, *75*
Methimazole, *123*
Methotrexate, *76, 96*
Miscarriage, *33*
Mitch, *22, 116*
Mitmita, *49, 57*
Mitn shiro, *39, 57*
Mixed function oxidases, *37,45, 84*

Morphine, *8*
Motion sickness, *79*
Mouthwash, *63*
Mucilage, *70, 72, 73, 158*
Mumps, *125, 158*
Mustard, *v, 42, 131, 132, 137*
Myalgia, *69, 158*
β-myrcene, *93, 129*
Myrrh, *140*
Myrtus communis, *99*

N

Nanna, *vi, 106*
Nausea, *34, 39, 57, 79-81, 95, 97, 106, 127, 150, 160*
Neche barzaf, *63*
Neche shinkurt, *74*
Nectar of the Gods, *74*
Netch shinkurt, *vi, 74*
Nigella sativa, 47, 48
Nightshade, *86*
NSAIDs, *11, 25, 50, 80, 120*
Nutmeg, *vi, 47, 100, 101, 129, 135, 140*
Nutmeg flower, *47*

O

O. lamifloium, *39*
O. suave, 39
Ocimum basilicum, 39
Oleaceae, *102*
Oleuropeoside, *103*
Olive, *vi, 13, 102, 103, 131, 132, 140*
Olive oil, *13, 102, 103, 132, 140*
Onion, *vi, 104, 105, 129, 131-135, 140, 141*
Opiates, 7
Oral hypoglycemic agents, *37, 40, 48, 51, 59, 70, 72, 76, 77, 80, 99, 103, 123, 128*
Organosulfides, *133, 134*
Otitis, *86, 88, 158*

P

Paclitaxel, *8, 128, 143, 145*
Palma christi, *53*
Paprika, *49*

Paresthesias, *34, 158*
Pastry, *122*
Pepe, *44*
Pepper, *vi, 39, 44, 45, 47, 49, 55, 57, 59, 74, 83, 84, 129, 131-134, 137-139*
Peppercorn, *44*
Peppermint, *vi, 106-108, 130, 141*
Pertussis, *86, 162*
Peru-apple, *86*
Pfeffer, *44*
Pharmacodynamic interactions, *3, 7*
Pharmacokinetic interactions, *3*
Phenothiazines, *86*
Phenprocoumon, *81*
Pigeon's grass, *125*
Pilocarpine, *8*
Pimenta, *44*
Pimpinella anisum, *36*
Piper longum, *83, 85*
Piper nigrum, *44*
Piperaceae, *44, 83*
Plant of Immortality, *33*
Plantaginaceae, *109*
Plantago lanceolata, *109*
Plantain, *vi, 109, 111, 132, 141*
Platelet aggregation, *40, 47, 50, 57, 72, 77, 79-81, 118, 122, 132*
Pneumonia, *42, 100, 102, 159*
Poivre, *44*
Poivre noir, *44*
Polyuria, *34, 159*
Pomegranate, *vi, 112, 131, 141*
Poor metabolizers, *6, 25, 26*
Pot, *95*
Potassium, *7, 33, 34, 53, 132, 137, 156*
Propranolol, *7, 45, 84, 131, 137, 139, 143, 144*
Protease inhibitors, 77, 96
Psoralens, *140*
Psoriasis, *36, 83, 102, 159*
Psychomimetics, *95*
Psyllium, *109, 110, 131*
Pumpkin, *vi, 114, 115, 141*
Punica granatum, *112*
Punicaceae, *112*
Purgative, *72, 118, 152, 159*
Pyrexia, *39*

Q

Qarafa, *55*
Qaria, *49*
Qelamitos, *63*
Qirinfud, *57*
Qobboo, *53*
QT prolongation, *54, 159*
Quara, *96*
Quat, *88*
Qucima, *53*
Quercetin, *134, 135*
Quinidine, *33, 145*
Quinine, *8*
Quinolones, *67*
Qullubbii adii, *74*
Qullubbii diimaa, *104*
Qundo berbere, *vi, 44*

R

Rabies, *49, 159*
Raffu, *42*
Raute, *116*
Rectal prolapse, *33, 86, 159*
Red pepper, *39, 49, 55, 57, 74*
Red pepper paste, *39, 55, 57, 74*
Rehan, *39*
Reserpine, *123, 142*
Respiratory ailments, *47, 63*
Retrovirus, *102*
Rheumatoid arthritis, *79, 102*
Ricinus communis, *53*
Rifampicin, *45, 84*
Ringworm, *39, 122, 160*
Rogi, *120*
Roman, *vi, 5, 47, 112*
Roman-coriander, *47*
Rou dou kou, *100*
Rue, *vi, 116, 117, 141*
Rue officinale, *116*
Rusda, *116*
Rustic treacle, *74*
Ruta chalepensis, *116*

Ruta graveolens, 116
Rutaceae, *91, 116*
Rutae folium, *116*

S

Sabbre-golla, *127*
Sacred basil, *40*
Safflower, *vi, 118, 119, 141*
Saigon cassia, *55*
Sawi, *95*
Scabies, *36, 44, 160*
Schriba, *49*
Scopolamine, *86*
Scurvy, *91, 150, 160*
Sedatives, *95*
Semen anisi, *36*
Semhal, *106*
Senafitch, *v*
Senafitcha, *42*
Sequinavir, *146*
Serrufit, *125*
Sertraline, *81, 144, 145*
Sessak, *39*
Sevoflurane, *34*
Shallots, *104*
Shi Liu, *112*
Shi Liu Pi, *112*
Shingles, *49, 102, 160*
Shucar, 59
Siljo, *42*
Simpler's joy, *125*
Simvastatin, *107, 108, 141, 146*
Skin problems, *61*
Soar throat, *112*
Solanaceae, *49, 86, 127*
Spanish psyllium, *109*
St. Josephwort, *39*
St. Paul's Hospital, *22*
Stews, *69, 122*
Stinking Rose, *74*
Stinkweed, *86*
Stinkwort, *86*
Stomach pain, *120*

Stomachache, *42, 44, 47, 59, 66, 79, 83, 93, 99, 116, 125*
Stomatitis, *63, 160*
Stramonium, *86*
Streptozocin, *64, 96*
Stringy bark tree, *63*
Sucralfate, *55, 137*
Sufi, *118*
Sulfadiazine, *45, 84*
Sunkutta, *104*
Sweet basil, *39, 130*
Sweet cumin, *36*
Swelling, *39, 105, 127, 151, 153-155, 162*

T

Tabasco pepper, *49*
Tachycardia, *34, 101, 159, 161*
Tachynea, *161*
Taeniasis, *23, 99, 109, 112, 114*
Taladam, *116*
Talba, *72*
Tallers, *116*
Tamare-hindi, *120*
Tamarind, *vi, 120, 142*
Tamarindo, *120*
Tamarindus indica, 120
Tannins, *88, 89, 131*
Tasmanian blue gum, *63*
Taverniera abyssinica, 23
Tchat, *88*
Tea, *55, 79, 88, 107, 126*
Tedj, 66
Tej sar, *vi, 93*
Tenadam, *vi, 116*
Tetracycline, *4, 45, 55, 56, 84, 146*
THC, *95, 96*
Theophylline, *24, 45, 51, 84, 96, 131, 137, 138, 140, 143, 145, 146*
Thiopental, *80*
Thorn-apple, *86*
Thrombolytic agents, *36, 37, 51, 57, 118, 122, 123*
Thyroid replacement therapy, *43, 45, 70, 76, 77, 89, 128*
Tibs wot, 57
Tinea corporis, *74, 161*
Tinea cruris, *74, 161*

Tinea pedis, *74, 161*
Tiqur azmud awaze, *39*
Tofoile, *53*
Tonsilitis, *91, 125, 161*
Toothache, *47, 49, 57, 74, 83, 86, 106*
Torsade de pointes, *54, 159, 161*
Trachoma, *109*
Tricyclic antidepressants, *6, 86, 96*
Trigonella, *69*
Trigonella foenum-graecum, *69*
Tuberculosis, *83, 99, 102, 127*
Turkey grass, 125
Turmeric, *vi, 13, 122, 123, 130, 133-135, 142*
Typhoid, *127*
Typhus, *74, 162*

U

Ulcers, *33, 40, 63, 69, 80, 83, 88, 123, 142*
Umbelliferae, *36, 59, 61, 66*
Urgo, *39*
Urinary incontinence, *66*

V

Venereal diseases, *88*
Verbena, *vi, 125, 126, 142*
Verbena herba, *125*
Verbena officinalis, *125*
Verbenaceae, *125*
Vercuronium, *80*
Vermifuge, *47, 83, 162*
Vinblastine, *76, 123, 146*
Vincristine, *76*
Vitamin B-12, *110*
Vitamin C, *91, 160*

W

Warfarin, *4, 6, 25, 42, 70, 76, 77, 107, 114, 117, 126, 132, 139, 141, 144*
Warts, 39, 53, 93, 104, 116, 162
Weed, *vi, 53, 86, 95, 125, 139*
White eucalyptus, *63*
White mint, *106*
Whooping cough, *63, 93, 99, 125, 162*

Wild fennel, *66*
Withania, *vi, 127, 128*
Withania somnifera, *127*
Wonder tree, *53*
Wot, *36, 39, 47, 57, 61, 66, 69, 79, 83, 100*
Wounds, *63, 69, 74, 93, 104, 109, 120, 122, 125*
Woyra, *vi, 102*
Wushsh, *114*

Y

Ye qola qusil, *49*
Yogurt, *116*
Yu jin, *122*

Z

Zaber, *33*
Zakakewe, *39*
Zinc, *67, 110*
Zingiber officinale, *79*
Zingiberaceae, *79, 122*
Zingibil, *vi, 79*
Zkuni, *114*
Zoxazolamine, *45, 64, 84*